DEXMEDETOMIDINE INFUSION DURING MIDDLE EAR SURGERY UNDER GENERAL ANAESTHESIA TO PROVIDE OLIGAEMIC SURGICAL FIELD: PROSPECTIVE STUDY

Dissertation submitted to

THE TAMILNADU DR.MGR MEDICAL UNIVERSITY

In partial fulfilment of the regulations for

The award of degree

ANAESTHESIOLOGY

M.D. BRANCH- X

THANJAVUR MEDICAL COLLEGE,

THANJAVUR - 613 004

THE TAMILNADU DR.MGR MEDICAL UNIVERSIT

CHENNAI - 600 032

MAY- 2018

CERTIFICATE

This is to certify that the dissertation entitled **" DEXMEDETOMIDINE INFUSION DURING MIDDLE EAR SURGERY UNDER GENERAL ANAESTHESIA TO PROVIDE OLIGAEMIC SURGICAL FIELD: PROSPECTIVE STUDY"** submitted by **Dr. ISHWARYA.J** in partial fulfilment for the award of the degree of **Doctor of Medicine in Anaesthesiology** by the Tamilnadu Dr.MGR Medical University, Chennai is a bonafide record of the work done by her in the Department of Anaesthesiology, Government Thanjavur medical college, during academic year 2015-2018.

Prof .Dr.ShanthiPaulraj M.D, D.G.O.,
Professor and Head of the Department
Department of Anaesthesiology,
Thanjavur medical college,
Thanjavur.

Prof.Dr.S.Jeyakumar M.S, M.ch
Dean
Thanjavur medical college
Thanjavur

DECLARATION

I, **Dr.ISHWARYA.J**, solemnly declare that dissertation titled

"DEXMEDETOMIDINE INFUSION DURING MIDDLE EAR SURGERY UNDER GENERAL ANAESTHESIA TO PROVIDE OLIGAEMIC SURGICAL FIELD: PROSPECTIVE STUDY" is a bonafide work done by me at Thanjavur Medical College, Thanjavur during 2015 to 2018..

This dissertation is submitted to **"The Tamilnadu DR.MGR Medical University, Chennai"** as a partial fulfilment for the requirement of **M.D Degree examinations -- (Branch-X) in Anaesthesiology** to be held in May 2018.

Place: Thanjavur

Date: (DR.ISHWARYA.J)

Thanjavur Medical College

THANJAVUR, TAMILNADU, INDIA - 613001

(Affiliated to the T.N.Dr.MGR Medical University, Chennai)

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Approval No. : 280

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submitted by Dr. J. ISHWARYA **of**

Dept. of ANAESTHESIA **Thanjavur Medical College, Thanjavur**

was approved by the Ethical Committee.

Thanjavur

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THANJAVUR.

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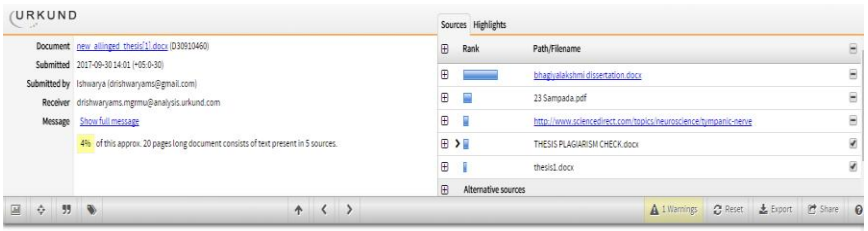

INTRODUCTION: Middle ear is a closed air filled cavity between the tympanic membrane and oval window. Surgeries done here under operating microscope needs bloodless field for better visualisation. This bloodless field is achieved through controlled or deliberate hypotension. Controlled or deliberate hypotension can be achieved through multiple modalities. Pharmacological and non pharmacological means can be used to achieve controlled hypotension. Non pharmacological methods include arteriotomy, positioning of surgical site higher, and positive pressure ventilation. Pharmacological means can be through intravenous or inhalational agents. Usage of drugs like vasodilators, beta adrenergic antagonists, alpha 2 agonist,calcium channel blockers. Inhalational agents like sevoflurane, isoflurane, desflurane can be used. Dexmedetomidine, a centrally acting alpha 2 agonist is being in used in many countries since many years. In India it was introduced in 2009 and a comparatively newer drug to our country. Several studies have shown that administration of dexmedetomidine during general anaesthesia reduces the MAC value of sevoflurane. The present study was undertaken to compare the effectiveness of dexmedetomidine to provide a bloodless surgical field under general anaesthesia during middle ear surgeries.

AIM OF THE STUDY: The aim of this study was to study the effect of dexmedetomidine infusion during middle ear surgeries under general anaesthesia to provide bloodless surgical field. OBJECTIVES: 1. To study the effect of dexmedetomidine on sevoflurane requirements during anaesthesia. 2. To study the effect of dexmedetomidine on surgical blood loss and hence on the duration of surgery. 3. To study the effect of dexmedetomidine on time to achieve target blood pressure in controlled hypotension.

ANATOMY: ANATOMY OF MIDDLE EAR1: The middle ear inhabits the petrous portion of the temporal bone and is filled with air secondary to communication with the nasopharynx via the Eustachian tube/ auditory tube.

CERTIFICATE II

This is to certify that this dissertation work titled " DEXMEDETOMIDINE INFUSION DURING MIDDLE EAR SURGERY UNDER GENERAL ANAESTHESIA TO PROVIDE OLIGAEMIC SURGICAL FIELD: A PROSPECTIVE STUDY" of the candidate Dr.ISHWARYA.J with registration number 201520203 for the award of the degree of Doctor of Medicine in the branch of Anaesthesiology. I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows 4 percentage of plagiarism in the dissertation.

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CONTENT

INTRODUCTION:

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Controlled or deliberate hypotension can be achieved through multiple modalities. Pharmacological and non pharmacological means can be used to achieve controlled hypotension.

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OBJECTIVES:

1. To study the effect of dexmedetomidine on surgical blood loss and hence on the duration of surgery.
2. To study the effect of dexmedetomidine on time to achieve target blood pressure in controlled hypotension.
3. To study the effect of dexmedetomidine on sevoflurane requirements during anaesthesia.

ANATOMY:

ANATOMY OF MIDDLE EAR[1]:

The middle ear inhabits the petrous portion of the temporal bone and is filled with air secondary to communication with the nasopharynx via the Eustachian tube/ auditory tube.

Middle ear extends from the tympanic membrane to the oval window and contains the bony conduction elements of the malleus, incus and stapes.

Walls of the tympanic cavity are complex with important association, as follows

(I) ROOF- TEGMENTAL WALL- separates middle ear from middle cranial fossa by thin layer of bone known as tegmen tympani.

(II) FLOOR- JUGULAR WALL- separates middle ear from internal jugular vein by thin layer of bone. Medial border of floor has small aperture to transmit the tympanic branch of glossopharyngeal nerve into the middle ear.

(III) LATERAL WALL- MEMBRANOUS WALL-formed by tympanic membrane. Bony lateral wall of epitympanic recess form the upper part of the membranous wall.

(IV) POSTERIOR WALL- MASTOID WALL- has two parts

Upper part- through epitympanic recess continuous with the aditus to the mastoid antrum.

Lower part- bony wall that separates tympanic cavity and mastoid air cells.

It also has two associated structures

i) Pyramidal eminence- tendon of stapedius muscle enters the middle ear through this.

ii) Chorda tympani nerve, a branch of facial nerve enters the middle ear through opening in it.

(V) ANTERIOR WALL- CAROTID WALL- has two parts

Lower part- separated from internal carotid artery by thin plate of bone.

Upper part- deficient, because

i) Pharyngotympanic tube enters through it into middle ear.

ii) Tensor tympani muscle enters through small opening into middle ear.

iii) Foramen of exit for Chorda tympani nerve from middle ear.

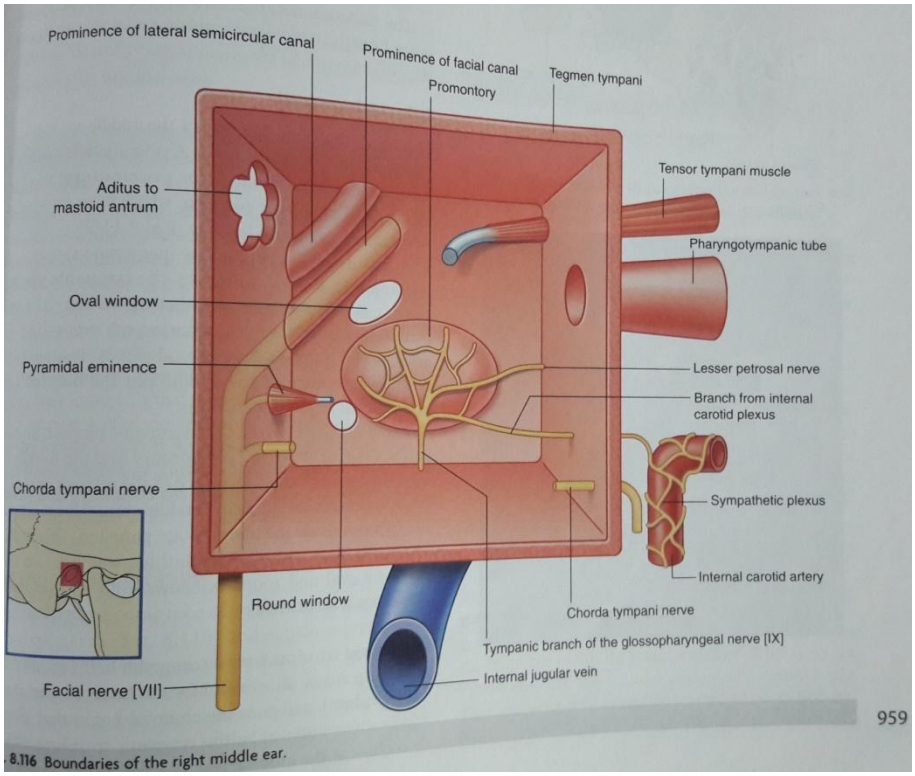
(VI) MEDIAL WALL- LABYRINTHINE WALL

- Also the lateral wall of inner ear.
- Promontory- by the basal coil of cochlea, the mucous membrane covering it has tympanic plexus of nerves.

- Two openings:
    i) Oval window – point of attachment for foot plate of stapes, lies posterosuperior to promontory.
    ii) Round window- lies posteroinferior to promontory.
- Two prominences:
    i) Prominence of the facial canal: produced by facial nerve as it passes through the temporal bone.
    ii) Prominence of the lateral semicircular canal: it is located above and posterior to the prominence of facial canal.

(VI) Floor of the middle ear is the jugular wall, it separates the tympanic cavity from the internal jugular vein.

BOUNDARIES OF MIDDLE EAR



8.116 Boundaries of the right middle ear.

Structures of the Middle Ear

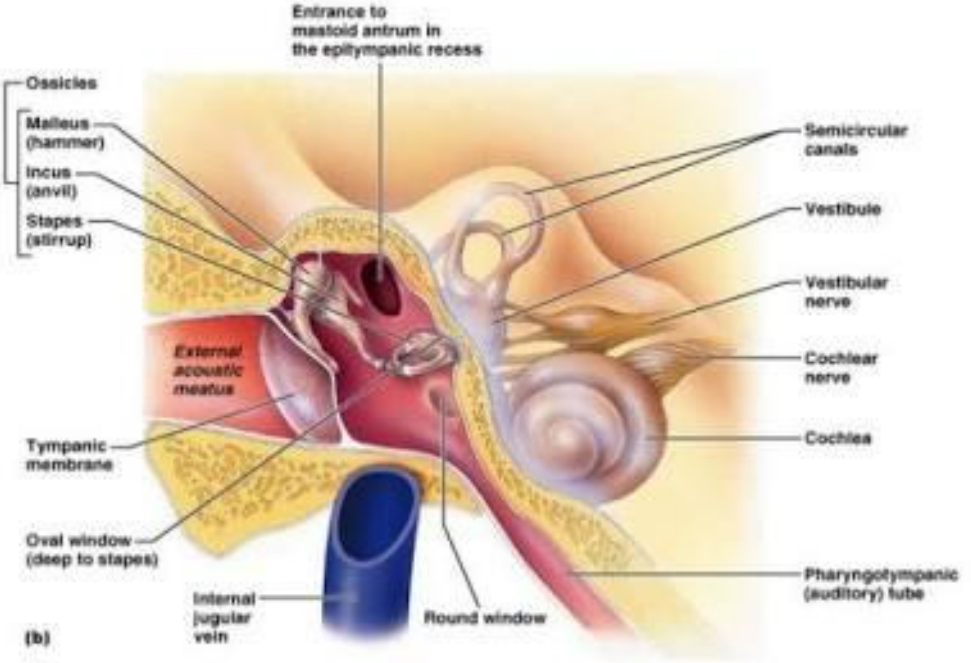


Figure 16.17b

Tympanic cavity:

Multiple structures are contained within the confines of the tympanic cavity. Muscles, nerves and the auditory tube occupy space within the tympanic cavity. The cavity is covered in mucoperiosteum.

Ossicles: from the deep surface of the tympanic membrane to the oval window is a chain of movable bones, the ossicles.

Malleus (hammer)

Incus (anvii)

Stapes (stirrup)

These bony elements serve to transmit and amplify sound waves from the air to the perilymph of the internal ear. This bony conduction amplifies 10 times the sound from air.

Auditory tube: is the communication between the middle ear and the nasopharynx. Its function is to equalize the pressure across the tympanic membrane. Contraction of tensor veli palatini and the salphingopharyngeus outside of the tympanic cavity dilate and open the auditory tube.

Muscles: Stapedius – this connects the neck of the stapes to the posterior tympanum .Contractions displace the stapes posteriorly and prevent loud noises from injuring inner ear. Nerve to stapedius from the facial nerve innervates stapedius.

The tendon of the tensor tympani attaches to the manubrium of malleus. Contraction tenses the tympanic membrane and dampening sound vibration as well. Supplied by the mandibular branch of the trigeminal nerve.

Intra tympanic nerves:

Tympanic plexus – nerve supply of the middle ear.

Lies on the promontory and supplies the medial surface of the tympanic membrane, tympanic cavity, mastoid air cells and the bony Eustachian tube.

Tympanic plexus is formed by the tympanic branch of the glossopharyngeal nerve- Jacobson's nerve.

Sympathetic fibres- carotico tympanic nerve comes from the sympathetic plexus around the internal carotid artery.

1. **Vascular supply:**

   Arterial supply:

   Tympanic branch of the maxillary A

   Stylomastoid branch of the posterior auricular A

   Petrosal branch of the middle meningeal A

   Branch from the ascending pharyngeal A

   Tympanic branch of the internal carotid A

Branch from the artery of pterygoid canal

Venous drainage:

To the pterygoid plexus and the superior petrosal sinus.

INNERVATIONS OF MIDDLE EAR

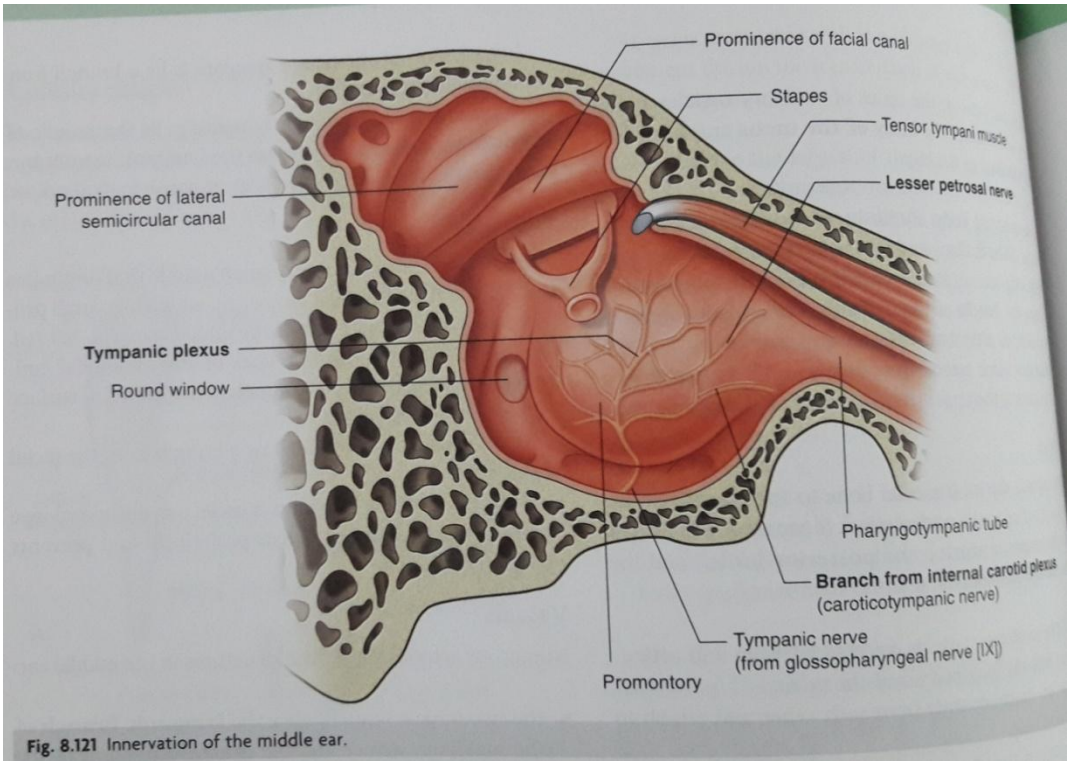


Fig. 8.121 Innervation of the middle ear.

Mastoid antrum:

Air containing space situated in the upper part of mastoid. Volume is 1 ml.

Roof: formed by the tegmen antri, separates mastoid antrum from the middle cranial fossa.

Lateral wall: squamous plate of temporal bone on which lies macewen's triangle an important landmark for mastoidectomy which is covered by the post aural skin.

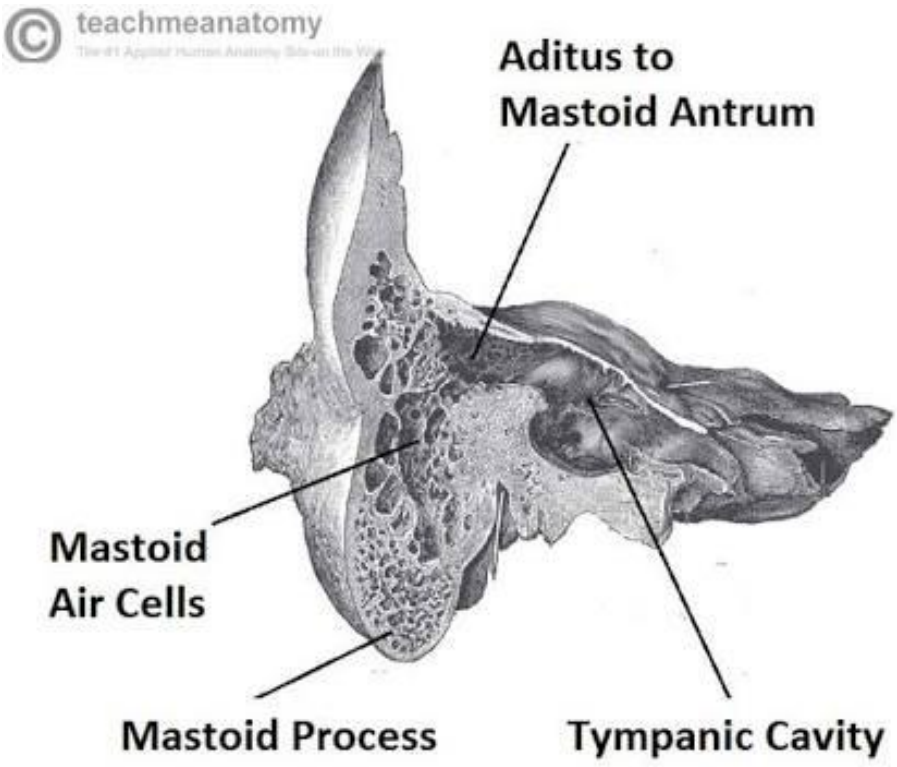
Medial wall: is formed by the petrous bone.

Anteriorly mastoid antrum communicates with the attic through the aditus and antrum.

Posterior wall: is formed by the mastoid bone and communicates with mastoid air cells.

Floor: is formed by mastoid bone and communicates with mastoid air cells. Mastoid air cell is the major contributor to the middle ear inflammatory diseases.

The middle ear can be visualised through mastoid by opening the facial recess.



CONTROLLED HYPOTENSION:

INTRODUCTION:

Controlled hypotension or deliberate hypotension is reducing arterial blood pressure in a predictable and deliberate manner.[2]

HISTORY AND EVOLUTION:

1917 – First introduced to provide bloodless field for neurosurgery.

1946 - Introduction of arteriotomy to achieve controlled hypotension[4].

1948- High spinal anaesthesia to induce hypotension.

1951- High epidural block introduced to achieve hypotension.

Subsequently the ganglion blockade was introduced using pentamethonium, suxamethonium, trimethaphan to achieve hypotension.

1962- Sodium nitroprusside was first introduced during anaesthesia to achieve hypotension[3].

Nitroglycerine, calcium channel blockers, beta blockers, purine compounds and prostaglandin E1 have been used. Deep anaesthesia using inhalational agents are also favoured by many[2].

PHYSIOLOGY:

As organ blood flow is normally well maintained, controlled hypotension rarely results in organ damage.

Auto regulation maintains the perfusion to vital organs.

CEREBRAL CIRCULATION:

By auto regulation normal cerebral flow is maintained at 45-50 ml/100g/min within a MAP 50 -150 mm Hg.

CORONARY CIRCULATION:

Coronary blood flow is dependent upon aortic diastolic pressure and coronary vascular resistance. Hypotension decreases coronary blood flow but it also reduces myocardial oxygen demand due to reduction in after load/ preload. Hence coronary auto regulation ensures adequate blood flow.

RESPIRATORY SYSTEM:

During hypotensive anaesthesia pulmonary blood flow gravitates to dependent areas of lung. Non dependent areas are well ventilated but not perfused, this is worsened due to head up position[5].

Intrapulmonary shunt is increased as the vasodilators inhibit hypoxic pulmonary vasoconstriction. All these results in hypercarbia, increased arterial-end tidal CO2 gradient and hypoxaemia[6].

RENAL CIRCULATION:

Auto regulation occurs between 80 -180 mmHg arterial blood pressure. Outside auto regulation the renal blood flow is pressure dependent. Glomerular filtration generally stops when systemic arterial pressure is less than 40- 50 mmHg.

HEPATIC CIRCULATION:

Liver is not an auto regulated organ. Total liver blood flow is regulated by hepatic arterial buffer response, hepatic cell metabolism does not control hepatic blood flow, and portal blood flow is the major intrinsic regulator of hepatic arterial tone. The impact of portal blood flow variations on total hepatic blood flow is buffered by hepatic blood flow. Controlled hypotension is well tolerated by liver not resulting in mortality and morbidity[7].

BLOOD PRESSURE GOAL:

It is suggested that inducing hypotension to a MAP of 30% below a patient's usual MAP, with a minimum of 50mmHg in ASA 1 patients and 80mmHg in the elderly is clinically acceptable[2].

TECHNIQUES OF HYPOTENSIVE ANAESTHESIA:

SVR can be reduced by peripheral vasodilators while cardiac output can be reduced by using drugs that lower venous return, myocardial contractility, heart rate or combination of these.

METHODS TO REDUCE CARDIAC OUTPUT:

1. Nitroglycerine to dilate the capacitance vessels and reduce preload[8].
2. Cardiac contractility and heart rate is decreased using inhalational agents[9] and beta blockers[10].
3. ARTERIOTOMY- letting of blood from radial artery until systolic BP of 80 mm Hg is reached. Hypotension achieved by reducing preload. The problems are acute blood loss leading to reduced oxygen delivery – compensatory vasoconstriction and reduced haemoglobin level. Metabolic acidosis developed rapidly. Not in use now.

METHODS TO REDUCE PERIPHERAL VASCULAR RESISTANCE:

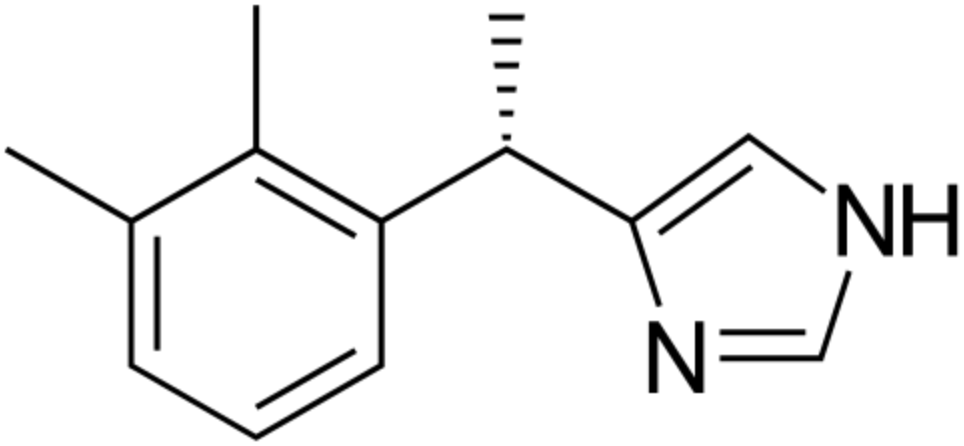
1. alpha adrenergic receptor blockers[11],
2. Directly acting vasodilators- sodium nitroprusside, calcium channel blockers, purines (adenosine) [13, 14], prostaglandin E1[12].
3. centrally acting alpha 2 agonist

MECHANICAL MANOEVERS TO POTENTIATE THE ACTION OF HYPOTENSIVE AGENTS:

1. POSITIONING: positioning the surgical site at a higher level promotes venous drainage[4].
2. POSITIVE PRESSURE VENTILATION: Respiratory manipulations to reduce venous return[15] are not usually employed during hypotensive anaesthesia.

PHARMACOLOGICAL REVIEW:

DEXMEDETOMIDINE



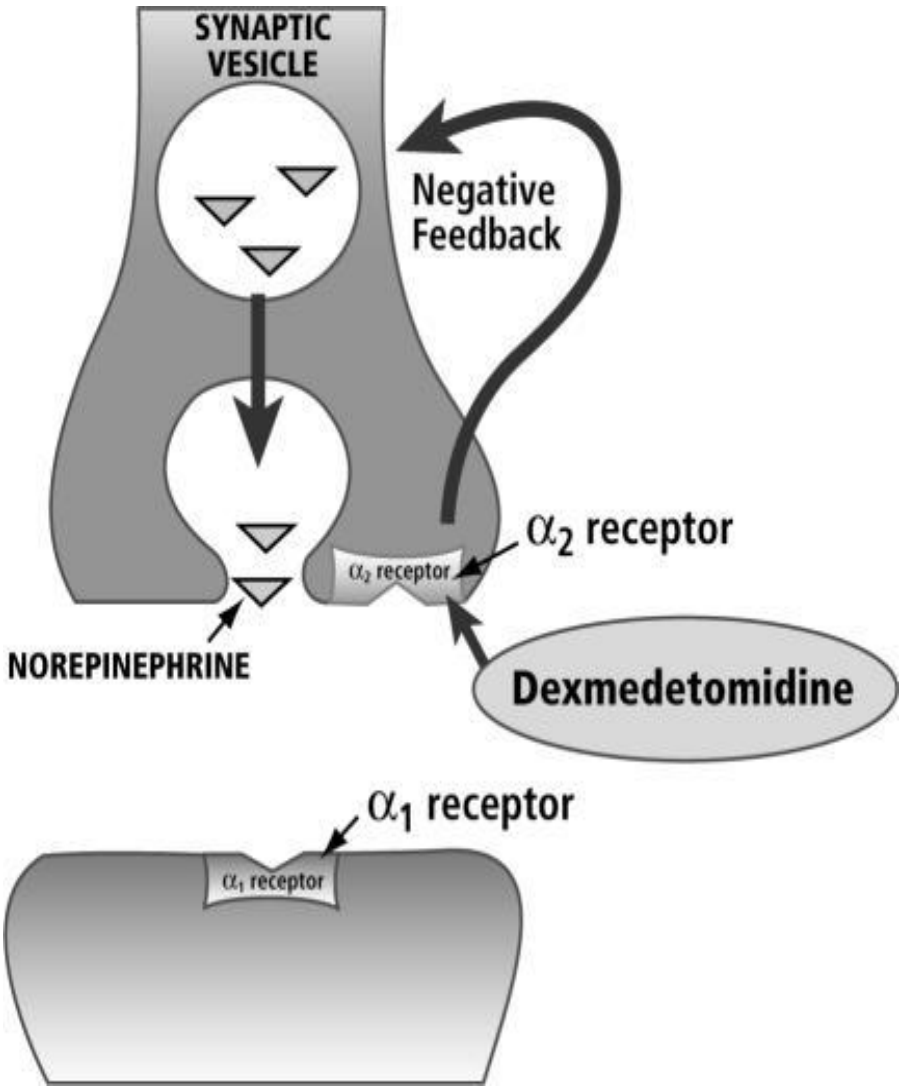
Food and drug administration at the end of 1999 approved dexmedetomidine for use in humans as a short term medication inICU for analgesia and sedation.

MECHANISM OF ACTION:

[16]Dexmedetomidine is an imidazole compound, active dextro isomer of medetomidine that shows selective and specific agonism to alpha 2 receptors. Neuronal hyperpolarization is the key action of aplha2 agonists. Thus, activation of alpha 2 receptors in the brain and spinal cord inhibits neuronal firing→ inhibits the release of nor epinephrine and terminates pain signals at presynaptic levels, postsynaptically at the CNS causes sympatholysis. A combined effect leads to hypotension, bradycardia, sedation, and anxiolysis.

Highest densities of alpha 2 receptors are present in locus ceruleus, predominant norepinephric nucleus in the brain and an important modulator of vigilance, also important modulator of nociceptive neurotransmission. Hence inhibition of neuronal firing here produces analgesia and sedation.

Dexmedetomidine is a highly specific, selective and potent alpha 2 adrenergic agonist – 1,620:1 alpha 2: alpha 1.



PHARMACOKINETICS:

It shows linear kinetics when infused in recommended dosage of 0.2to 0.7 mcg/kg/hour. The elimination half life is around 2 hours. The steady state volume of distribution is 118 L, the half life of distribution is 6 minutes. The average protein binding of dexmedetomidine is 94%. Decxmedetomidine undergoes biotransformation by all hepatic processes, through direct glucuronidation and cytochrome P450 metabolism. Metabolites are excreted in urine (95%) and in faeces (4%). No age or sex related difference in pharmacokinetic profile.

EFFECT ON INHALATIONAL AGENTS:

Aho et al found patients receiving dexmedetomidine showed 25% reductions of maintenance concentrations of isoflurane[17].

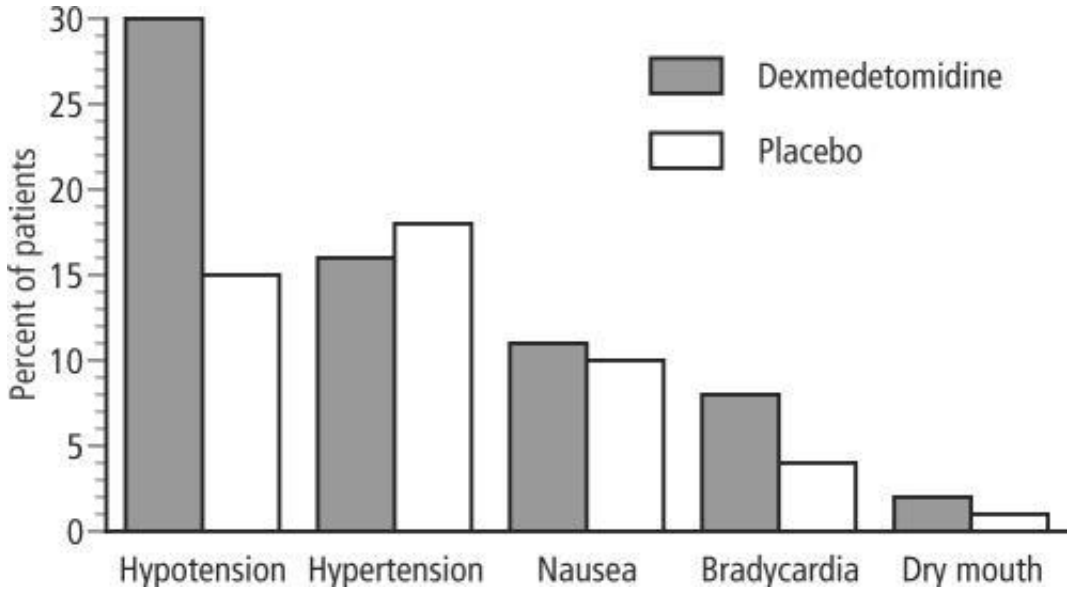
Khan et al showed reduction of isoflurane by 35 to 50% in patients treated with low or high dose dexmedetomidine and isoflurane without premedication[18].

Fragen et al showed 17% decrease of sevoflurane for maintenance of anaesthesia in elderly undergoing elective surgery[19].

ADVERSE EFFECTS:

Includes hypotension, bradycardia, hypertension, nausea, vomiting, atrial fibrillation and hypoxia. Most of these are associated with loading dose hence reduced by omitting loading dose[20].

Overdose may cause first degree or second degree atrio ventricular block



CLINICAL USES:

- Tracheal intubation hemodynamic effect is attenuated[21].
- Plasma catecholamine concentration during anaesthesia is decreased[23].
- Requirement of perioperative opioids and inhalational agents is decreased[23].
- Also effective treatment of shivering[24].
- Preservation of spontaneous breathing- hence potential anaesthetic technique for patient with difficult airway[25].
- Post operative sedation: 0.2 to 0.7 mcg /kg/hr IV is useful for sedation of ICU patients. Sedation exhibits some similarity to natural sleep[25].

REVIEW OF LITERATURE:

In a study by Gupta et al (2016), dexmedetomidine infusion during middle ear surgeries under general anaesthesia to provide oligaemic surgical field was studied as a prospective study. For middle ear surgeries using operative microscope, dexmedetomidine was used as anaesthetic adjuvant and clinical effects of dexmedetomidine infusion at 0.5mcg/kg/hour was studied in 32 adult patients, 32 other patients were given placebo infusion of normal saline. To maintain systolic BP 30% below baseline value, statistically significant reduction in isoflurane concentration(0.8±0.6%) in dexmedetomidine infusion group than those receiving placebo infusions (1.6±0.7%). Statistically significant reduction in bleeding at surgical site in dexmedetomidine group than placebo group (p value<0.05). The mean awakening time and recovery from anaesthesia did not show significant difference between the two groups. He concluded that, dexmedetomidine can be safely used as anaesthetic adjuvant to provide oligaemic surgical field for middle ear surgery using operating microscope.

In a study by shah et al (2016) to evaluate dexmedetomidine infusion in middle ear surgery, to maintain hypotensive anaesthesia .In 50 adult patients, 25 patients received loading dose of dexmedetomidine 1mcg/kg over 10 mins given before induction followed by infusion of 0.4 mcg/kg/hour; 25 other

patients received normal saline. Analysis of results showed that requirement of intraoperative isoflurane was statistically less in dexmedetomidine group (1.72±0.61) than normal saline group (3±0.64). Bleeding score by surgeon at the end showed dexmedetomidine group had lesser bleeding and good surgical field than normal saline group. No statistically significant sedation in dexmedetomidine group in comparison with normal saline group, hence safe.

Sarkar et al (2016) conducted a randomized double blind, placebo controlled study to assess the effectiveness of dexmedetomidine in reducing blood loss during middle ear surgery under general anaesthesia in 54 adult patients. 27 patients received dexmedetomidine loading dose of 1mcg/kg/hour over 10 mins followed by steady infusion of 0.4mcg/kg/hour, while 27 other patients received same volume of normal saline as placebo. Dexmedetomidine showed significantly lower bleeding intraoperatively and at end of surgery opinion by surgeon than placebo (p value <0.05). Hence he concluded that dexmedetomidine significantly reduces Intraoperative bleeding thus better visibility of operative field and surgeon satisfaction.

In a study by Dal et al(2004), comparison of desflurane ,isoflurane, sevoflurane along with continuous remifentanil infusion of 0.5 mcg/kg/min to induce hypotension for tympanoplasty. He found that desflurane, sevoflurane

and isoflurane had similar effects when used in combination with remifentanil in providing blood less surgical field. Hemodynamic effects were similar for all the three agents during tympanoplasty. The mean bleeding scores at the 40th minute of the operation were significantly lower in the sevoflurane group compared to both isoflurane and desflurane groups. In conclusion, the study showed that that desflurane, sevoflurane and isoflurane combined with remifentanil provided adequate induced hypotension and that any of these agents may be equally and safely used in anaesthesia for tympanoplasty.

Study by Nasreen et al,(2009) to assess the hypotensive effect of low does dexmedetomidine infusion during middle ear surgery in 42 adult patients. Loading does of 1μg/kg IV bolus dexmedetomidine given 10-15 minutes prior to induction, thereafter infusion of 0.4μg/kg/hr started in 21 patients of dexmedetomidine group. Halothane was titrated to achieve a mean arterial pressure 30% below the control baseline value. Analysis of results showed significant reduction in the percentage of halothane required to reduce mean arterial pressure 30% below control value in dexmedetomidine group 1.3±0.4 than placebo group 3.1±0.3. Patient receiving dexmedetomidine had a better surgical field as compared to patients receiving placebo. The study concluded that dexmedetomidine can be safely administered to provide hypotensive anaesthesia during middle ear surgery keeping the hemodynamic fluctuations within the physiological range.

Shams et al (2013), conducted a comparative study of dexmedetomidine versus esmolol for induced hypotension for functional endoscopic sinus surgery in 40 adult patients. 20 patients were given dexmedetomidine of 1μg/kg loading dose over 10 minutes before induction of anaesthesia followed by 0.4-0.8 mcg/kg/hour infusion during maintenance and 20 patients of esmolol group received loading does 1 mg/kg esmolol over 1 minute followed by 0.4-0.8 mg/kg/hr during maintenance to maintain mean arterial blood pressure between 55-65 mm Hg. Sevoflurane 2-4% was titrated to maintain general anaesthesia. Both groups reached the desired MAP (55-65 mm/kg) with no significant differences between two groups. At 5 to 10 minutes after stoppage of hypotensive agents, at end of surgery and after recovery MAP was significantly lower in dexmedetomidine group than esmolol group. Mean intraoperative fentanyl consumption in dexmedetomidine group (25.0±2mcg) was significantly less than esmolol group (60±3.5). Intraoperative bleeding scores were comparable between two groups. Emergence time and time was significantly shorter in esmolol group than dexmedetomidine group. Mean postoperative sedative scores were significantly lower in esmolol group than dexmedetomidine group at 15 minutes post extubation. First analgesic request time was significantly shorter in esmolol group (30.25±5.15 mins) than dexmedetomidine group (57.6±8.22mins). From the study it is concluded that

dexmedetomidine or esmolol with sevoflurane are safe agents for controlled hypotension and both are effective in providing ideal surgical field during FESS. Dexmedetomidine offers the advantage of inherent analgesic, sedative and anaesthetic sparing effect than esmolol.

Na Young Kim et al (2013) studied the effect of dexmedetomidine on sevoflurane requirements and emergence agitation in children undergoing ambulatory surgery. Primary end point of this study was end tidal sevoflurane to maintain a BIS score of 45-50 during surgery. Loading does of 1μg/kg dexmedetomidine over 10 minutes followed by 0.1μg/kg/hr infusion. The results of this study suggest that intraoperative dexmedetomidine infusion reduced anaesthetic requirements and decreased emergence agitation. p value<0.05.Despite low dose dexmedetomidine ,end tidal sevoflurane was reduced by 28.8-67% compared with normal saline group.

In a study by Harsoor et al (2014), effect of intraoperative dexmedetomidine infusion on sevoflurane requirement and blood glucose levels during entropy-guided general anaesthesia. This study was designed to evaluate the effect of intravenous dexmedetomidine infusion during general anaesthesia for abdominal surgeries on blood glucose levels and on sevoflurane requirements during anaesthesia in 40 adult patients. 20 patients received

dexmedetomidine at 1 mcg/kg over 10 minute loading dose followed by 0.5µg/kg/hr till end of surgery. 20 other patients received normal saline as placebo. Mean hourly sevoflurane requirement was reduced in dexmedetomidine group (11.10±2.17 ml)than normal saline group (15.45±3.97 ml).intraoperative heart rate , systolic blood pressure and mean arterial pressure were lower in dexmedetomidine group than placebo ($p<0.05$).The demand for epidural analgesia was by 1st hour in 13 patients who received placebo and 1 patient from dexmedetomidine group, while 19 patients from dexmedetomidine group and 7 patients from placebo demanded for epidural analgesia by end of 2 hours. Thus the study concludes that dexmedetomidine reduces the sevoflurane requirement, stable intraoperative hemodynamics with good analgesia and sedation.

In a study by Vineela et al (2015), dexmedetomidine compared with nitroglycerin in functional endoscopic sinus surgery for controlled hypotension in 60 adult patients. 30 patients received dexmedetomidine loading dose 1mcg/kg over 10 minutes followed by infusion of 0.2 to 0.7 mcg/kg/hour titrated to achieve target BP, 30 other patients in nitroglycerin group received infusion started at 0.5mcg/kg/min titrated to 0.5 to 10mcg/kg/min to achieve target BP. Target MAP 65-75mm Hg. The average blood loss in

dexmedetomidine group was 137.33±23.91ml while in nitroglycerin group was 152.9±23.7 ml, p value<0.05.

Both nitroglycerin and dexmedetomidine can be used safely for controlled hypotension in functional endoscopic sinus surgeries to achieve a target mean arterial pressure around 65-75mm of Hg. The average blood loss is less with dexmedetomidine when compared with nitroglycerin.

Bayram et al (2014), compared between magnesium sulphate and dexmedetomidine in controlled hypotension during functional endoscopic sinus surgery. Out of 60 adult patients, 30 patients received 40 mg/kg magnesium sulphate loading dose in 100 ml normal saline over 10 minutes followed by infusion of 10-15mcg/kg/hour and other 30 received initial loading of 1mcg/kg dexmedetomidine in 100ml normal saline over 10 minutes followed by 0.4mcg/kg/hour infusion during surgery. Bleeding scores were significantly lower with dexmedetomidine group with p value 0.02. Intraoperative mean arterial pressures were significantly lower in dexmedetomidine group. The number of patients who required nitroglycerin to reach target blood pressure was lesser with dexmedetomidine group, p value 0.01. The surgeon satisfaction on surgical site bleeding was significantly higher with dexmedetomidine group, p=0.001. The duration to reach aldrete score ≥9 was significantly shorter with

dexmedetomidine group, p=0.001. He concluded that dexmedetomidine produces effective controlled hypotension and thus aids in better visibility at surgical site than magnesium sulphate.

Sadiq et al (2017) studied the efficacy of dexmedetomidine infusion to provide oligaemic surgical field in middle ear surgeries. In forty adult patients, 20 patients were given dexmedetomidine infusion at 0.5 mcg/kg/hour remaining 20 patients received normal saline infusion as placebo. Dexmedetomidine group showed significantly lesser bleeding and surgical field visibility than normal saline group, p value <0.05. Post extubation heart rate was higher with normal saline group, while dexmedetomidine group showed comparatively lower mean heart rate throughout the surgery and post extubation. The awakening time post operatively was insignificant between two groups with p value 0.365.

MATERIALS AND METHODS:

This clinical study was conducted in Department of anaesthesiology, Thanjavur medical college in association of Department of Oto-rhino-laryngology during the period 2015-16. Clearance was obtained from hospital ethical committee for the study. This study was conducted on 60 adult patients planned to undergo middle ear surgeries were enrolled in this study. They were randomly allocated to one of the two study groups. Group I dexmedetomidine group and Group II normal saline group.

PATIENT SELECTION:

Inclusion criteria:

- ASA I & II
- Age 18 to 45 years
- Weight 46-65 kg
- Scheduled for elective middle ear surgery

Exclusion criteria:

- Patient refusal
- Presence of cardiac or respiratory disease
- Hypertension
- Obesity (BMI> 26kg/sq m)
- Hepatic / renal dysfunction
- Bleeding or coagulation disorders
- Anticipated difficult airway
- Patients on sedatives, hypnotics, antihypertensives.
- History of allergy to drugs or food.

Pre anaesthetic preparation:

- NPO since 10 PM the previous night.
- Patients were premedicated with ranitidine 0.25mg/kg, ondansetron 4mg and glycopyrrolate 0.04 mg/kg intra muscularly in preoperative room 60 minutes before surgery.
- Two separate 18G intravenous lines established.

In the operating room

- On arrival to operation theatre monitors were attached (heart rate, Spo2, ECG, NIBP) and baseline vital parameters- heart rate, oxygen saturation, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded.
- Patients were premedicated with midazolam (2 mg) and fentanyl (2mcg/kg) intravenously 15 minutes before induction of anaesthesia.
- After preoxygenation with 100% for 3 minutes, induction of anaesthesia with propofol (2 mg/kg) till loss of verbal commands and vecuronium 0.1 mg/kg were used to facilitate tracheal intubation.
- Group I (DEX) received infusion of dexmedetomidine 0.5 mcg/kg/hour after induction of anaesthesia till 20 minutes before completion of surgery. 50 mcg of dexmedetomidine was diluted in 100 ml normal saline and infusion rate administered according to body weight of the patient.
- Group II (NS) received placebo infusion of normal saline 100 ml after induction of anaesthesia till 20 minutes before completion of surgery.
- Anaesthesia was maintained with 60% nitrous oxide with oxygen and sevoflurane was titrated to achieve target BP of either less than 30% of baseline systolic BP or below 30% of baseline MAP whichever is higher. At any point MAP <50 mmHg was not allowed.

- Intraoperative monitoring was done at 10 minutes interval throughout the surgery till the end of the procedure

    i) Heart rate

    ii) Systolic blood pressure.

    iii) Diastolic blood pressure

    iv) Mean arterial pressure

    v) Sevoflurane dial concentration.

    Patients were monitored for any adverse effects like bradycardia and hypotension beyond target blood pressure.

- Sevoflurane dial concentration was titrated to treat hypotension beyond target blood pressure.

- At the end of the procedure, surgeon was asked to assess the bleeding at the surgical site.

    GRADE 0- no bleeding – excellent

    GRADE 1- minimum bleeding – sporadic suctioning needed

    GRADE 2- diffuse bleeding – repeated suction needed

    GRADE 3- considerable troublesome bleeding and continuous suction was needed.

- Residual neuromuscular blockade after surgery was antagonized with neostigmine (0.05 mg/kg) and glycopyrrolate (0.008 mg /kg). After

adequate motor recovery and spontaneous breathing efforts patients were extubated.

- Postoperative heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation at the end of 10 minutes after extubation were recorded. Patient was shifted to post op recovery room and monitored for 30 minutes before shifting them to ENT ward.

OBSERVATIONS AND RESULTS:

This is a prospective, randomized, controlled study done in 60 adult ASAI and II patients of either sex aged between 18 – 45 years, posted for elective middle ear surgeries under general anaesthesia. All 60 patients completed the study without any exclusion. Inter group analysis was done and the collected data were analysed using appropriate statistical test.

DEMOGRAPHIC CHARACTERISTICS OF STUDY POPULATION:

Table 1: Age distribution

S.No	Study group	MEAN ±SD (Age in years)	p value	Statistical test
1	GROUP I(DEX)	28.27 ± 7.31	0.152	Student ‘t’ test
2	GROUP II(NS)	25.53 ± 7.3		

In 30 patients of dexmedetomidine group the mean age was 28 years, while mean age was 26 years in 30 patients of normal saline group. Student ‘t’ test was used to test the significance, p value was 0.152, which was <0.05.Hence statistically insignificant.

Graph 1: Mean age distribution

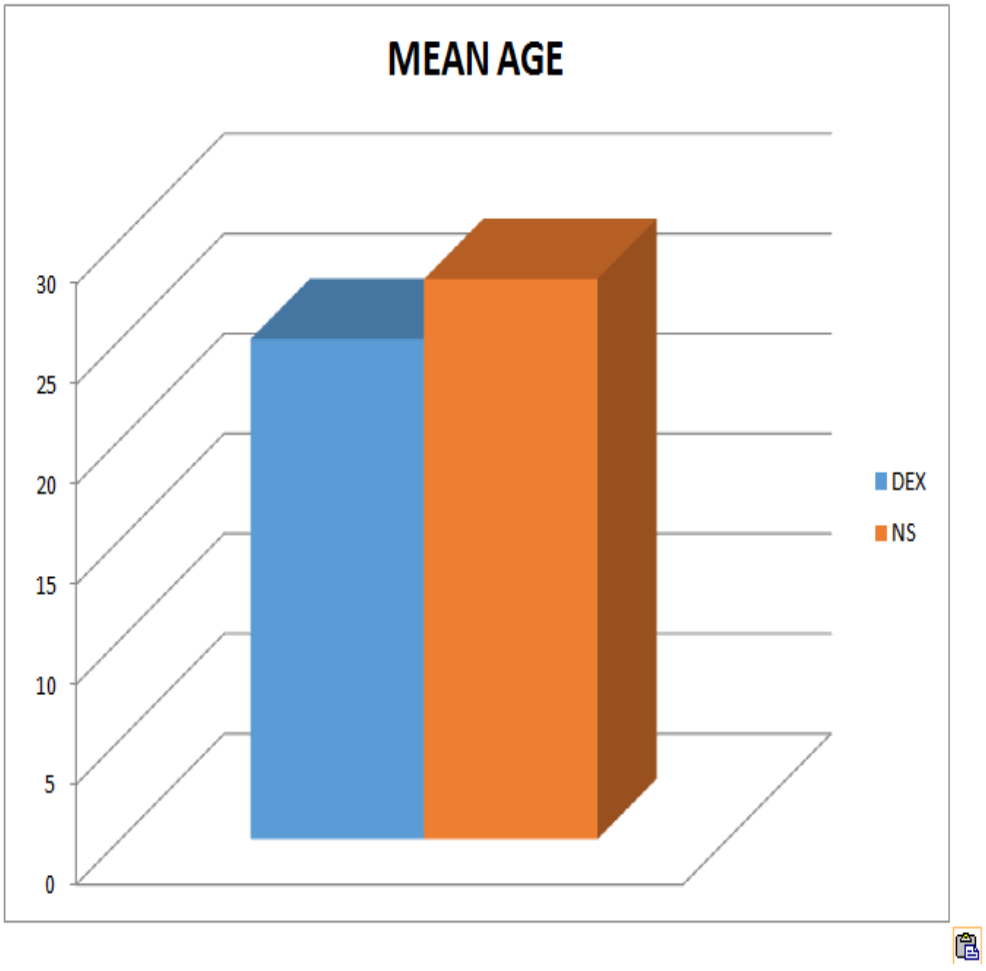


Table 2: Weight distribution

S.No	Study group	MEAN±SD (Weight in Kg)	p value	Statistical test
1	GROUP I(DEX)	56.33 ± 5.54	0.339	Student ‘t’ test
2	GROUP II(NS)	57.63 ± 4.9		

In 30 patients of dexmedetomidine group, the mean weight was 56 kilograms, while it was 58 kilograms in 30 patients of normal saline group. Student ‘t’ test was used to test the significance, p value was 0.339 which was<0.05, hence weight distribution among both groups was statistically insignificant.

Graph 2: Mean weight distribution

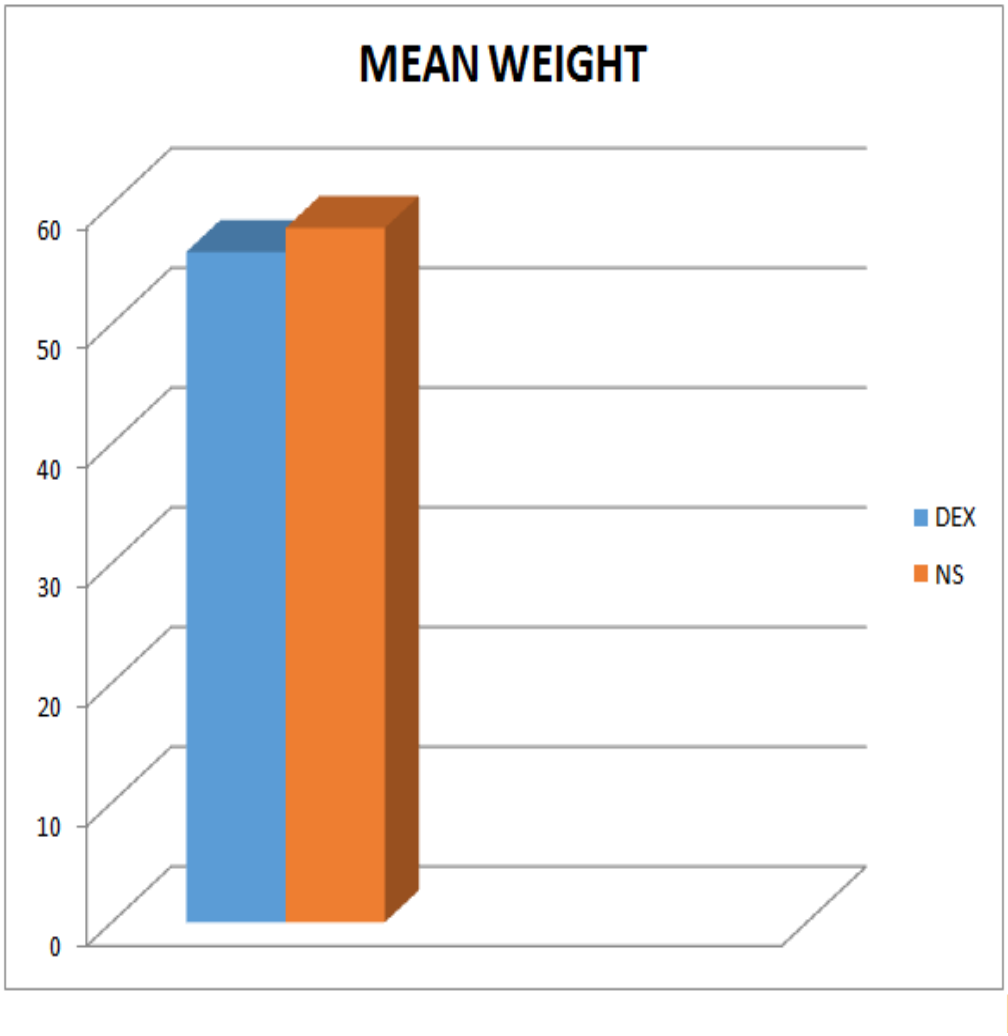


Table 3: ASA status

S.No	GROUP	ASA I	ASA II	P value
1	GROUP I(DEX)	12	18	0.722
2	GROUP II(NS)	14	16	

Out of 30 patients of dexmedetomidine group, 12 patients belonged to ASA I status and 18 patients belonged to ASA II status. Out of 30 patients of normal saline group, 14 patients belonged to ASA I status and 16 patients belonged to ASA II status. Student‘t’ test was used to test the significance, p value was 0.722 which was < 0.05, hence ASA status among both groups were not statistically significant.

Graph 3:ASA status

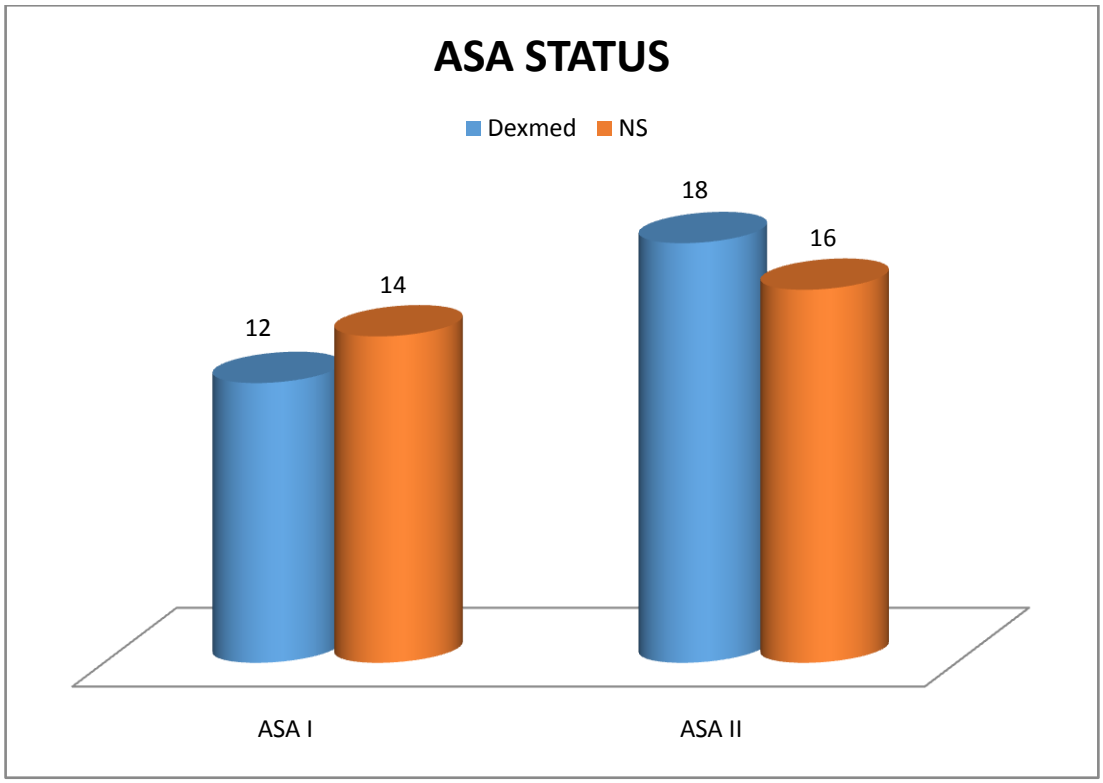
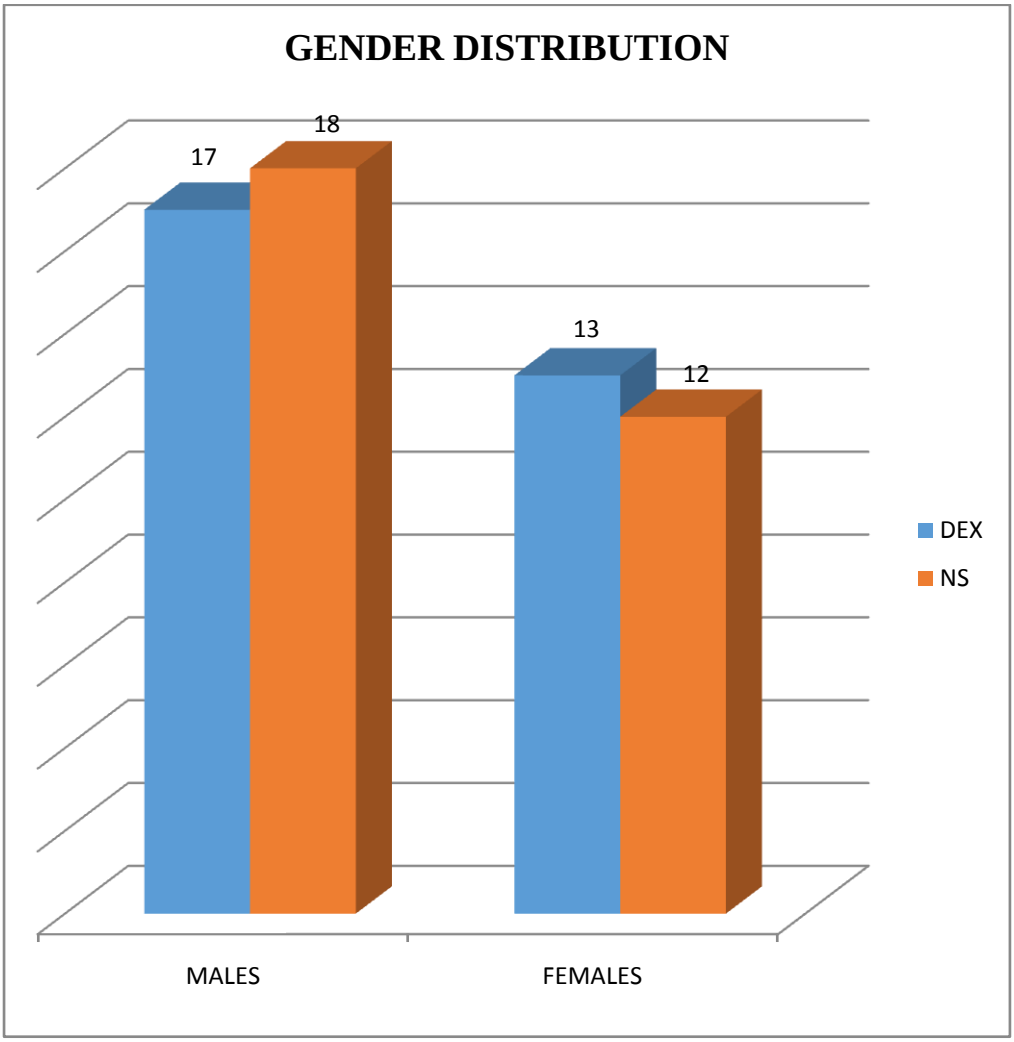


Table 4: Gender distribution:

S.No	Study group	Male	female	p value	Statistical test
1	GROUP I(DEX)	17	13	0.301	Fischer test
2	GROUP II(NS)	18	12		

Out of 30 patients in dexmedetomidine group, 17 patients were male and 13 patients were female. Out of 30 patients in normal saline group 18 patients were male and 12 patients were female. Fischer test was used to test the level of significance. p value was 0.301, which was <0.05, hence gender distribution is statistically not significant.

Graph 4: Gender distribution



HAEMODYNAMIC PROFILE:

Table 5: Baseline mean heart rate

S.No	Study group	MEAN±S.D (heart rate / min)	p value	Statistical test
1	GROUP I(DEX)	85.17 ± 1.789	0.521	Un paired ‘ t’ test
2	GROUP II(NS)	86.60 ± 1.322		

Baseline heart rates in both the groups were compared. 30 patients of dexmedetomidine group had baseline mean heart rate of 85 beats per minute, 30 patients of normal saline group had baseline mean heart rate of 86 beats per minute. Unpaired t test was used to test the level of significance, p value was 0.521, hence baseline hear rate among both groups were statistically insignificant.

Graph 5: Baseline mean heart rate

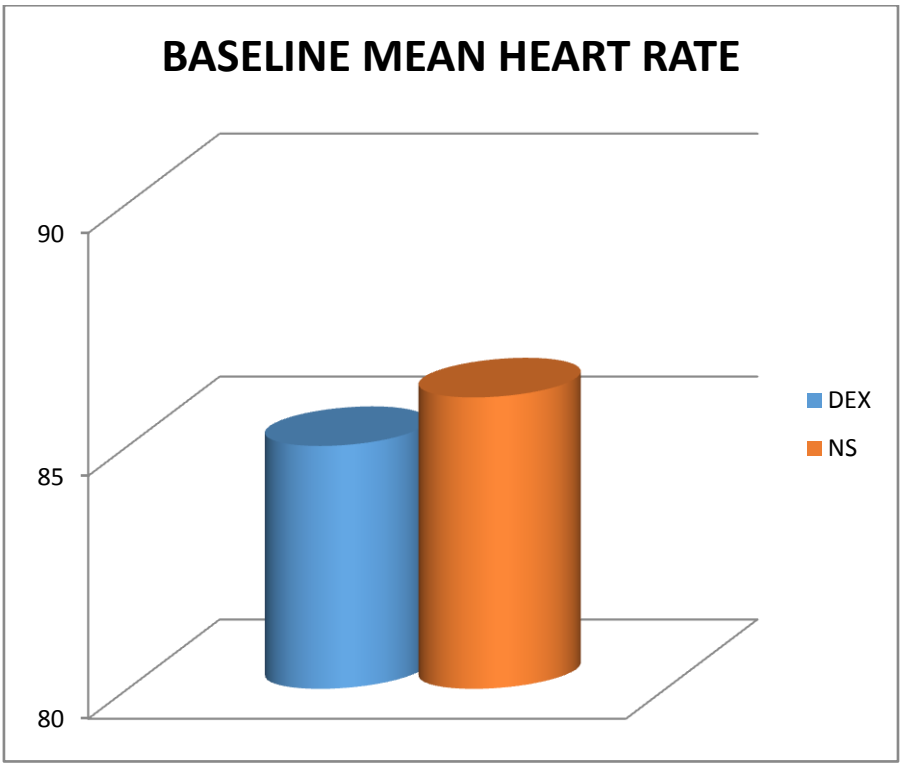


Table 6: Intraoperative heart rate

S. No	Heart rate at various time	DEX group (n=30)	Normal Saline Group (n=30)	P value	95 % Confidence interval
1	Pre-operative	85.17 ± 9.7	86.6 ± 7.24	0.521	-5.29 to 8.157
2	At induction (0 mins)	99 ± 12.61	98.2 ± 11.61	0.966	-7.523 to 5.923
After induction:					
3	10 mins	73.8 ± 6.38	90.03 ± 10.1	<0.0001	9.51 to 22.96
4	20 mins	68.8 ± 5.64	86.07 ± 9.27	<0.0001	10.54 to 23.99
5	30 mins	65.7 ± 6.43	82.2 ± 7.4	<0.0001	9.77 to 23.22
6	40 mins	62.77 ± 3.7	79.5 ± 6.42	<0.0001	10.01 to 23.46
7	50 mins	62 ± 3.76	77.37 ± 6.4	<0.0001	8.64 to 22.09
8	60 mins	61.48 ± 3.69	76.33 ± 6.56	<0.0001	8.06 to 21.63
9	70 mins	61.42 ± 2.56	74.67 ± 2.56	<0.0001	6.26 to 20.22
10	80 mins	62 ± 2.44	73.8 ± 6.08	<0.0001	4.58 to 19.02
11	90 mins	62 ± 1.41	73.69 ± 6.06	<0.05	0.72 to 22.66
12	Post extubation10 mins	68.77 ± 4.54	91.6 ± 6.24	<0.0001	16.11 to 29.56

Dexmedetomidine group showed significantly lower heart rate ranging from 60 to 90 beats per minute, while normal saline group showed heart rate ranging from 70 to 100 beats per minute. Two-way ANOVA with bonferroni post hoc test was performed to test the statistical significance. p value was < 0.0001, hence statistically significant.

Graph 6: Intraoperative heart rate

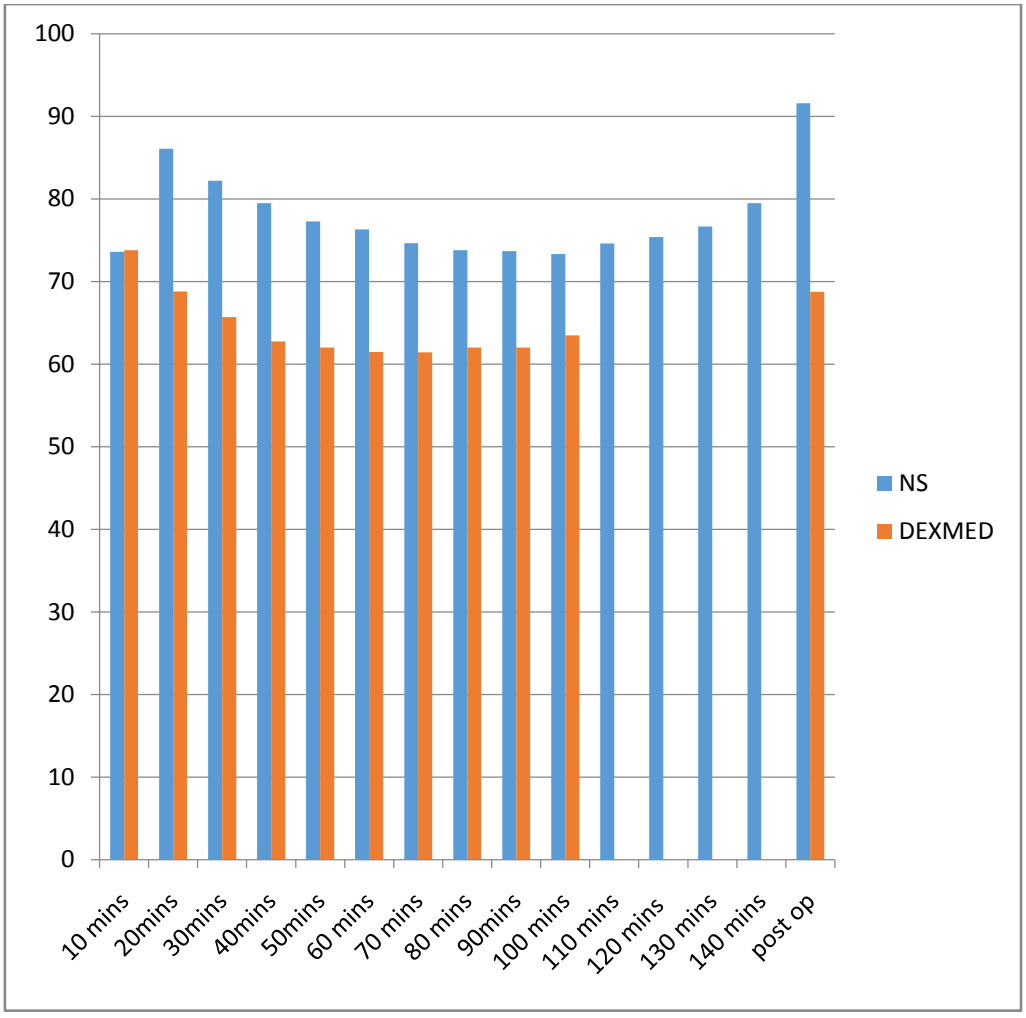
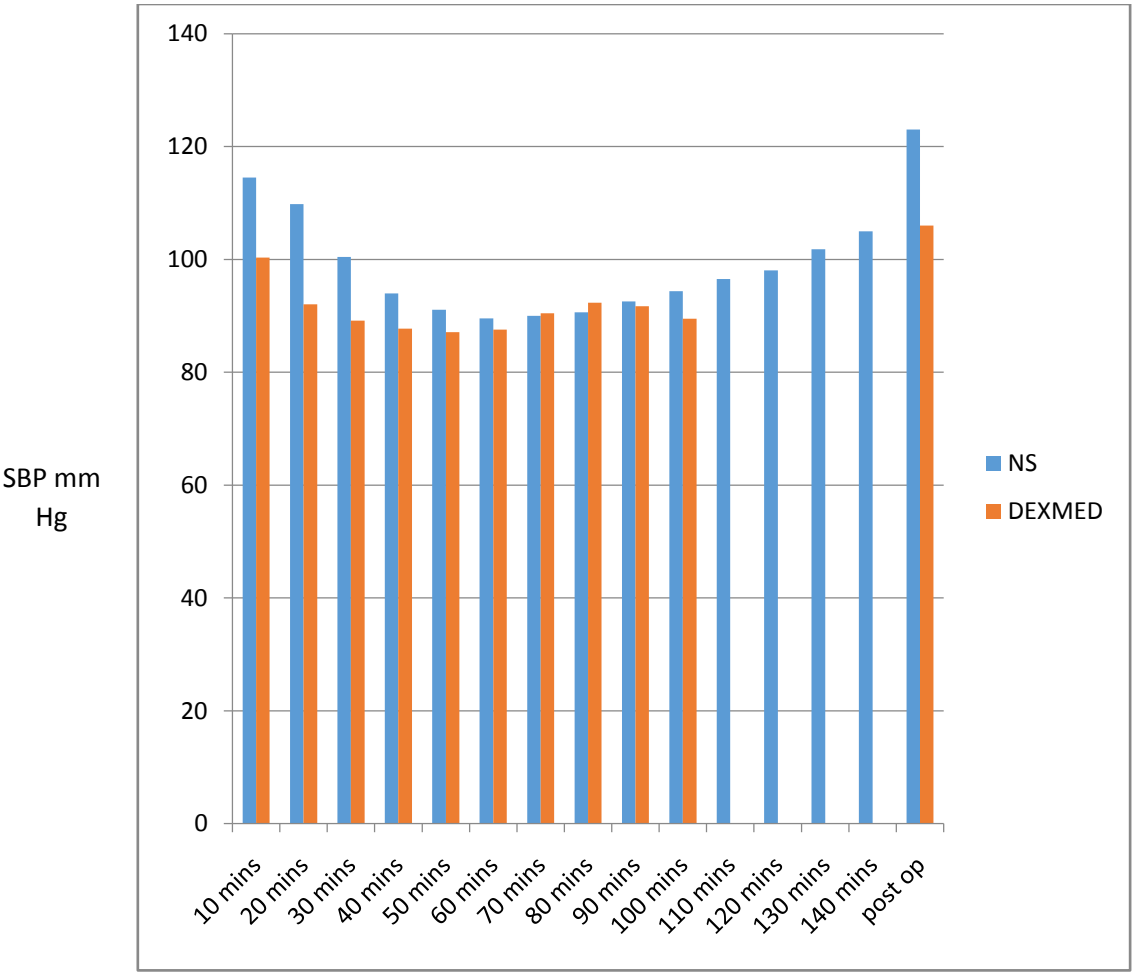
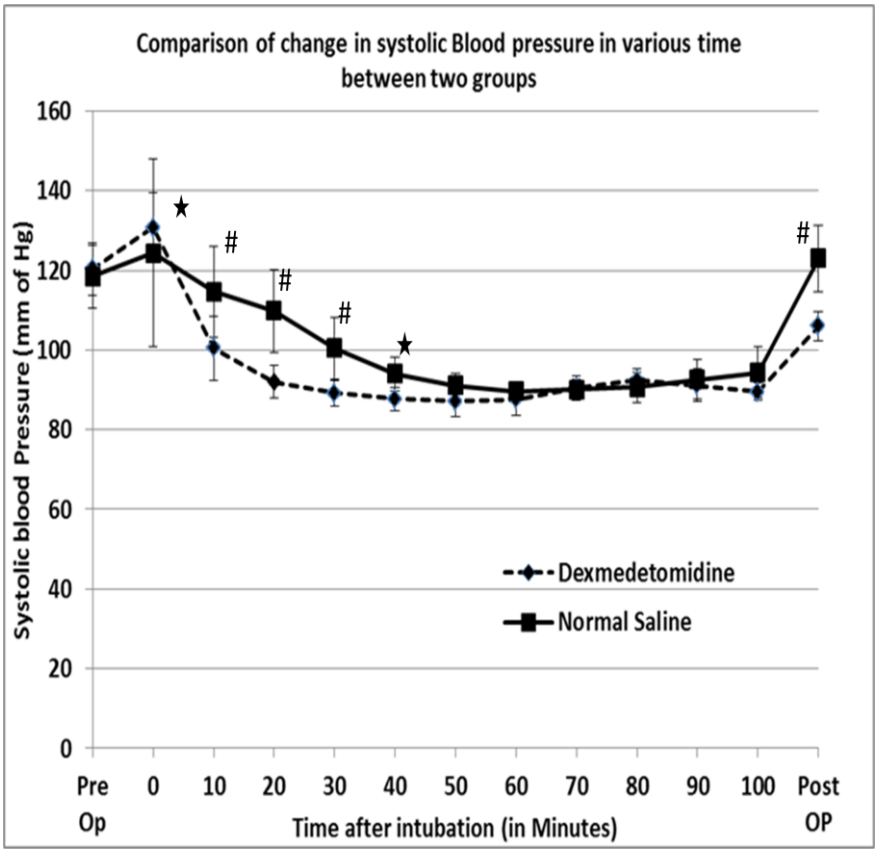


Table 7: Systolic blood pressure



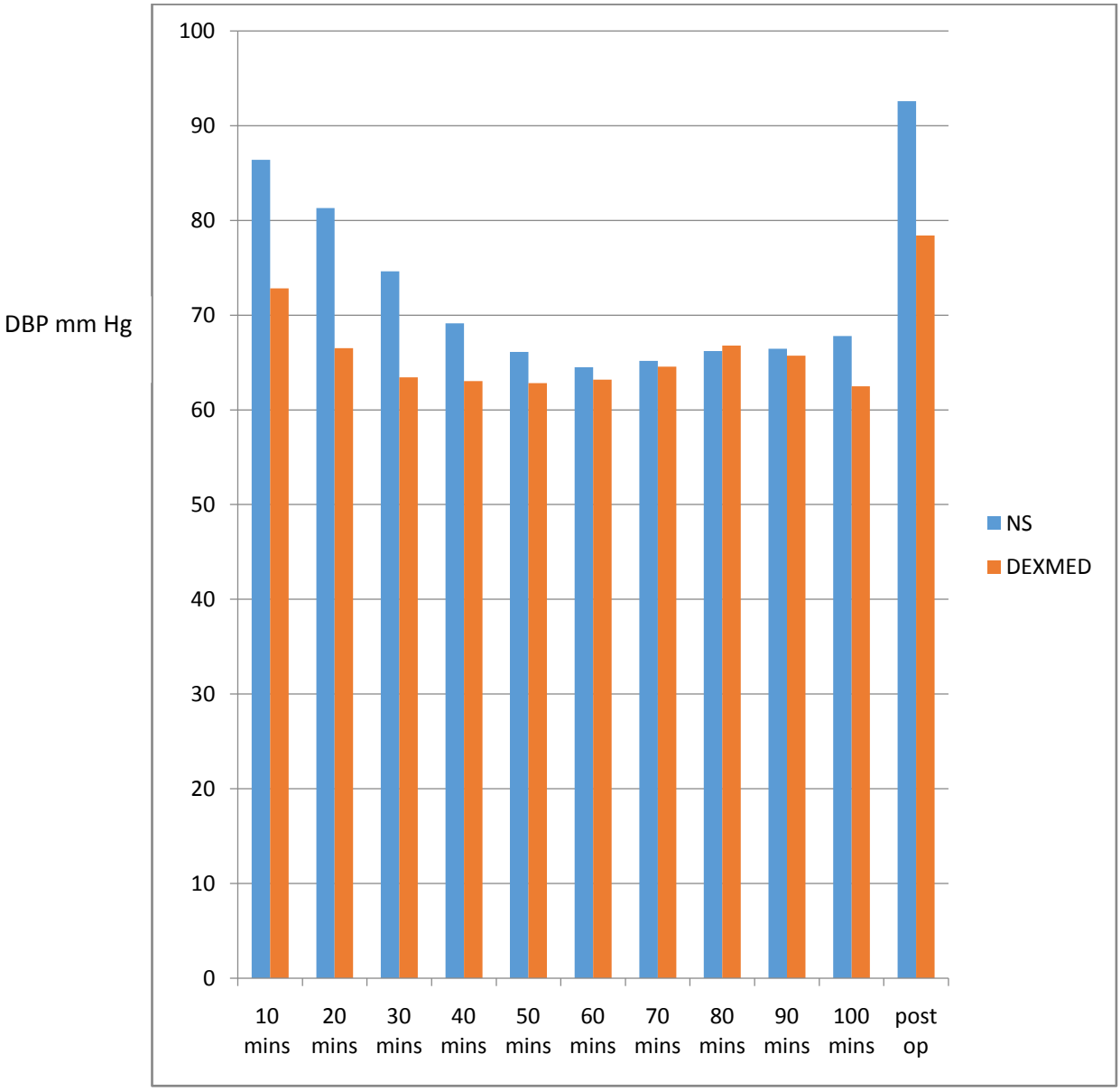
Graph 8: Comparison of change in systolic blood pressure between two groups



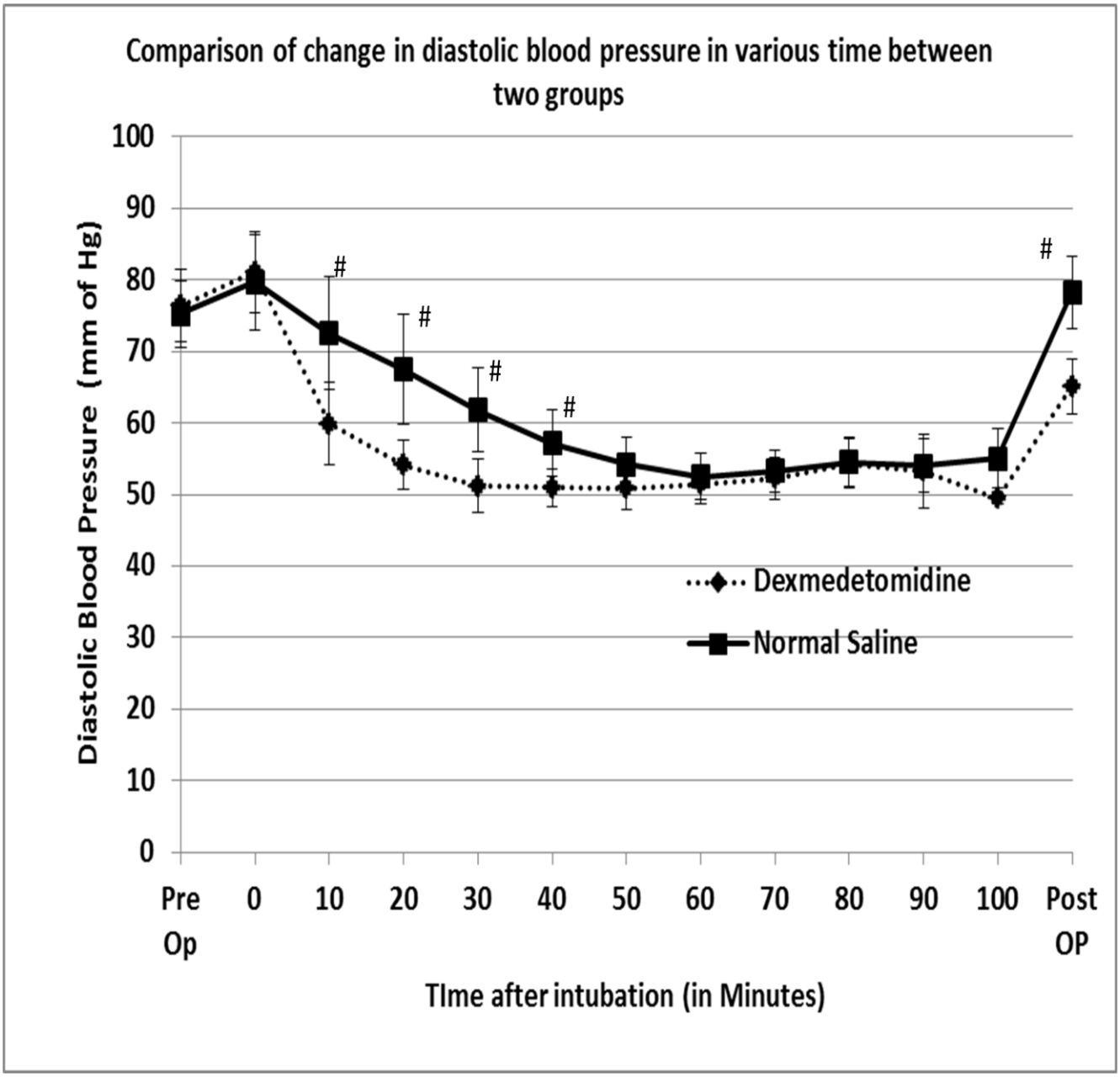
From graph:8, we can understand that,

Preoperative systolic blood pressure comparison between dexmedetomidine and normal saline group was not significant. Systolic blood pressure from induction till 40 minutes intraoperatively shows statistical significance between two groups (p value<0.05). Systolic blood pressure from 50 minutes intraoperatively till 100 minutes shows no statistical significance between two groups. The 10 minutes post extubation systolic blood pressure was significantly lower in dexmedetomidine group than normal saline group, p value <0.0001. Two- way ANOVA with Tukey post hoc test was done for statistical significance.

Graph 9: Diastolic blood pressure:

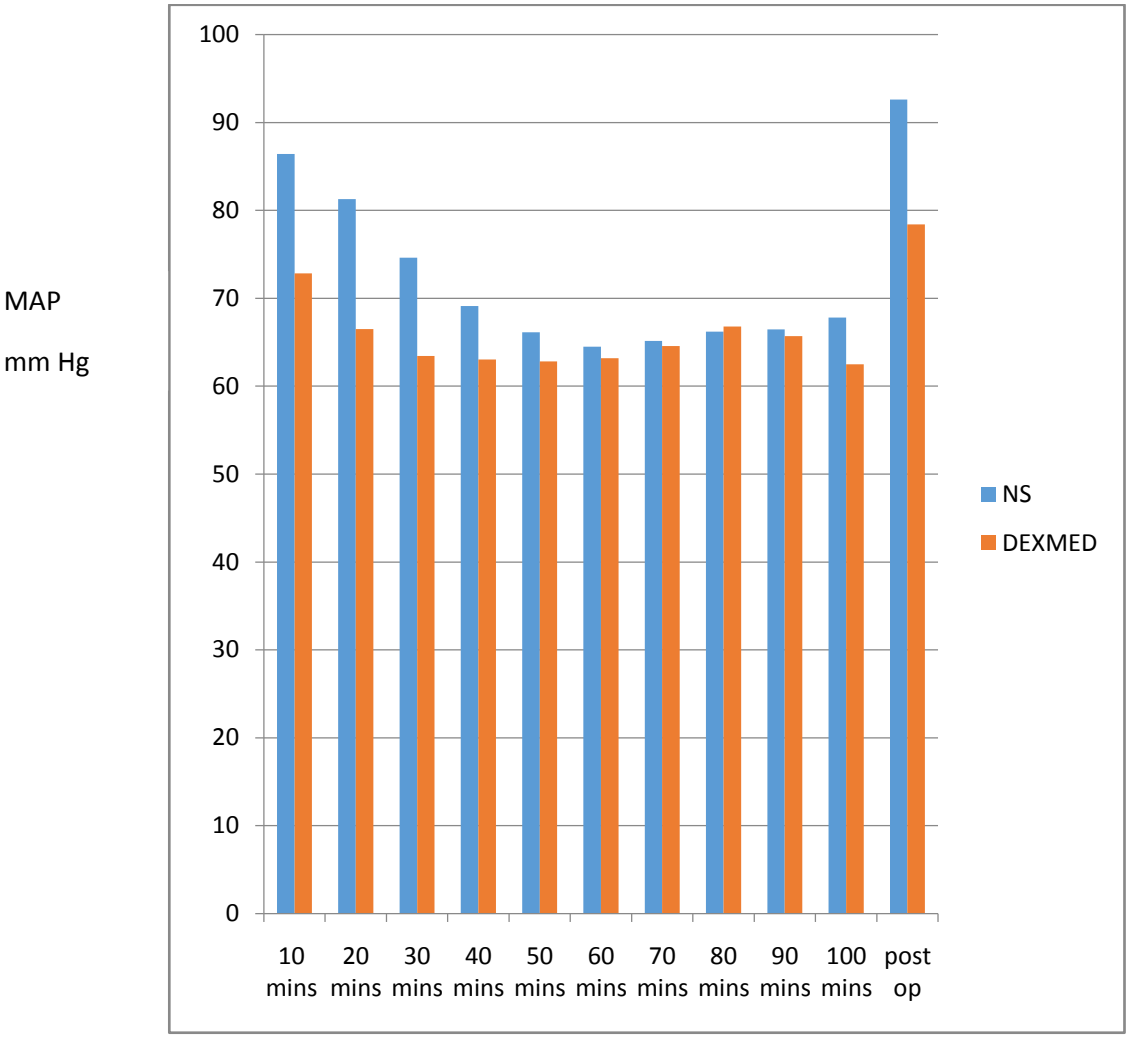


Graph 10:Comparison of change in Diastolic blood pressure between two groups

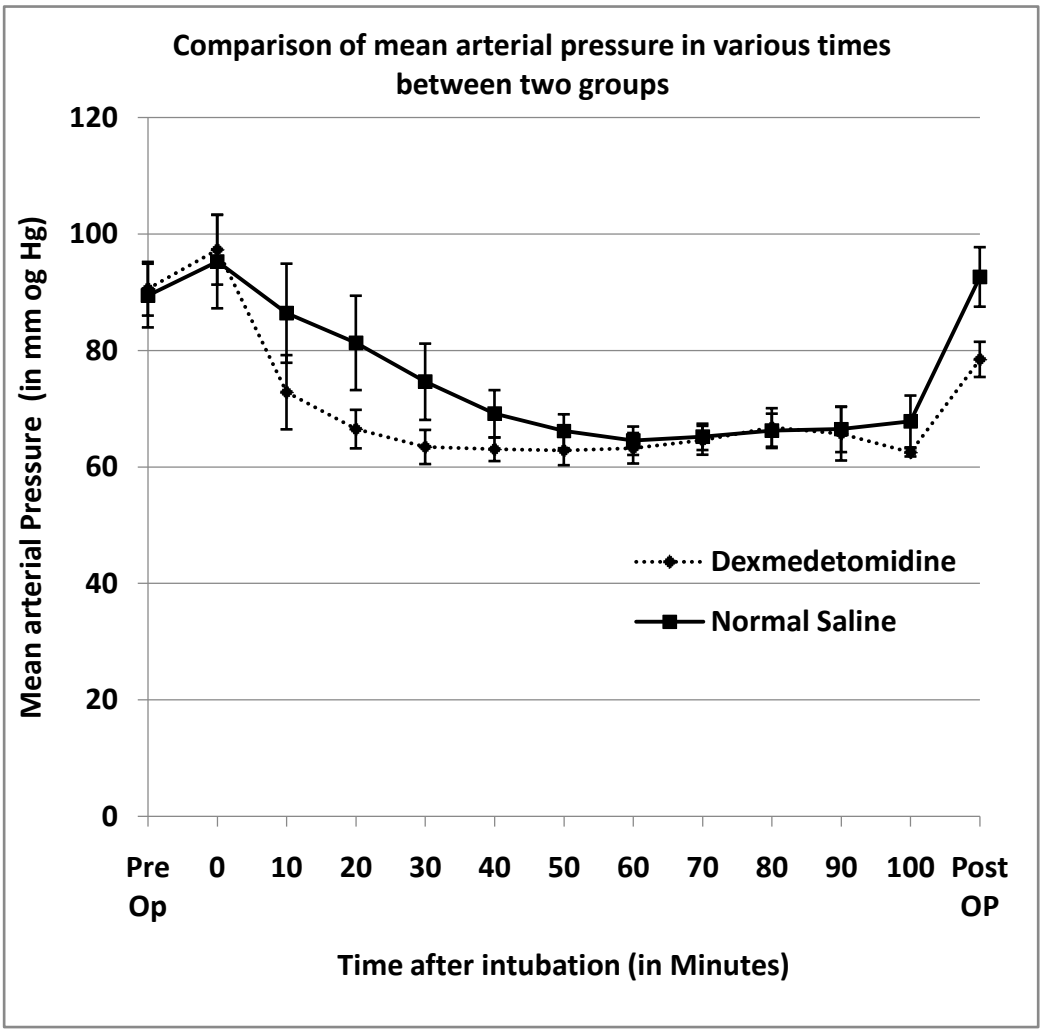


From graph: 10, we can understand that, pre operative diastolic blood pressures were comparable between two groups with no statistical significance. Diastolic blood pressure 10 minutes after induction till 40 minutes intraoperatively, dexmedetomidine group shows significantly lower diastolic blood pressure than normal saline group with p value<0.0001. 10 minutes post extubation value was significantly lower with dexmedetomidine group than normal saline group with p value<0.0001. Two-way ANOVA with Tukey post hoc test was done for statistical significance.

Graph 11: Mean arterial pressure



Graph 12: Comparison of change in Mean arterial pressure between two groups



From graph: 12, we can understand that

Mean arterial pressure preoperatively and at induction were not statistically significant between two groups. Mean arterial pressure from 10 minutes till 50 minutes intraoperatively shows statistical significance between two groups, with mean arterial pressure comparatively lower in dexmedetomidine group with a p value<0.0001. Mean arterial pressure from 60 minutes till 100 minutes intraoperatively shows no statistical significance in both the groups. The 10 minutes post extubation mean arterial pressure was significantly lower in dexmedetomidine group than normal saline group, p value<0.0001. Two-way ANOVA with Tukey post hoc test was done for statistical significance.

Table 7: Sevoflurane requirement to reach target blood pressure:

S. No	Group name (n=30/group)	Percentage of sevoflurane (MEAN±SD)	p value
1	GROUP I(DEX)	0.72±0.13	<0.0001
2	GROUP II(NS)	1.43±0.32	

The sevoflurane requirements, to achieve and maintain controlled hypotension were analysed. 30 patients of dexmedetomidine group required sevoflurane dial concentration ranging from 0.69% to 0.85%. 30 patients of normal saline group required sevoflurane dial concentration ranging from 1.11% to 1.75%. Mann- Whitney U test was used to test the level of significance with p value<0.0001, hence statistically significant. Thus dexmedetomidine group had a significantly lesser requirement of sevoflurane dial concentration to achieve and maintain target blood pressure than normal saline group.

Graph 13: Sevoflurane requirement to reach target blood pressure

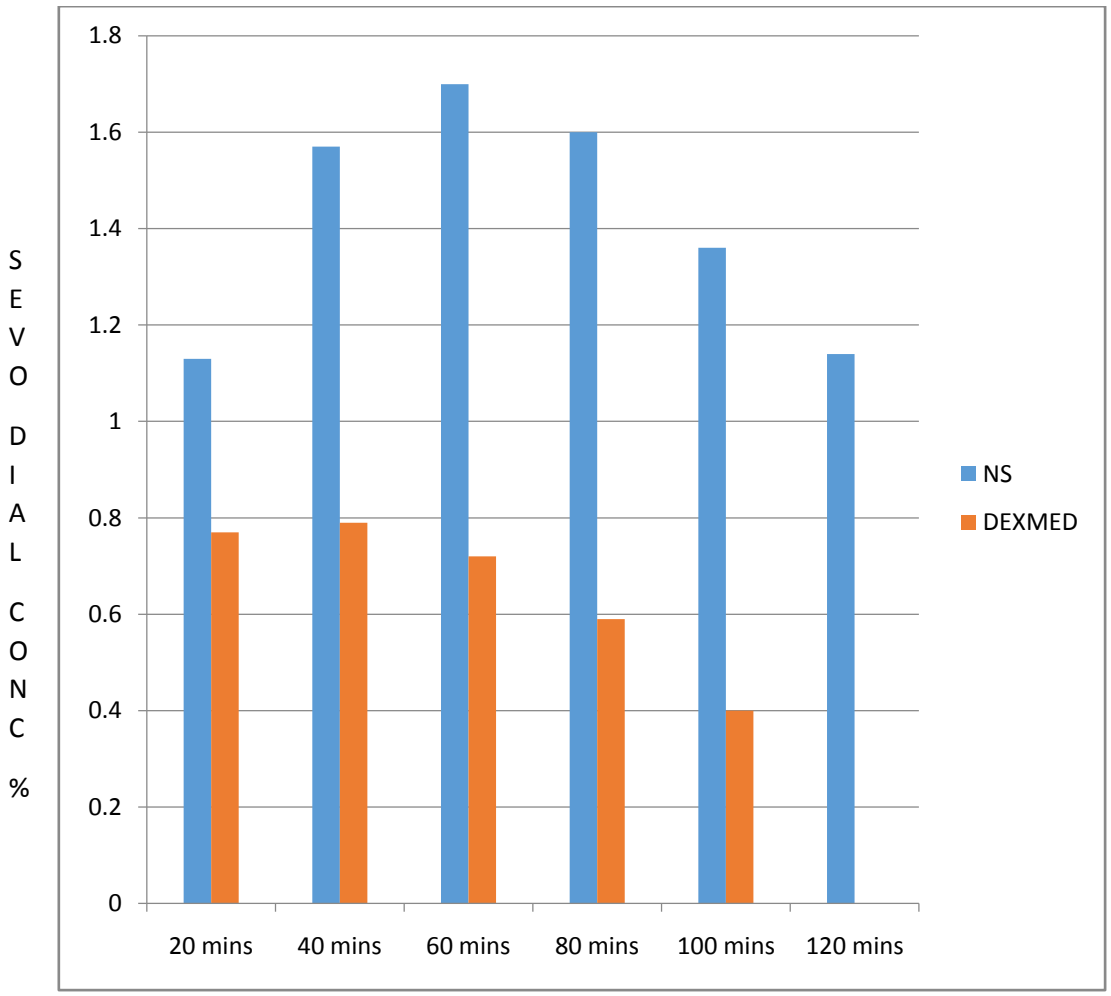


Table 8: Grade of bleeding

S.No	Group name	Grade of bleeding (n=30)		P value	Statistical test
		Grade 1	Grade 2		
1	GROUP I(DEX)	27 (90%)	3 (10%)	<0.0001	Chi square test for proportions
2	GROUP II(NS)	7 (23.3%)	23 (76.7%)		

Out of 30 patients of dexmedetomidine group, 27 patients had grade 1 bleeding (minimal bleeding with sporadic suctioning), remaining 3 patients had grade 2 bleeding (repeated suctioning needed). Out of 30 patients of normal saline group, 7 patients had grade 1 bleeding (minimal bleeding with sporadic suctioning) 23 other patients had higher bleeding grade of 2. The results were compared. Chi square tests for proportions was used to test the level of significance (p value <0.0001), hence significant. Thus patients of dexmedetomidine group had statistically significant lower grade of bleeding than normal saline group.

Graph 14:Grade of bleeding

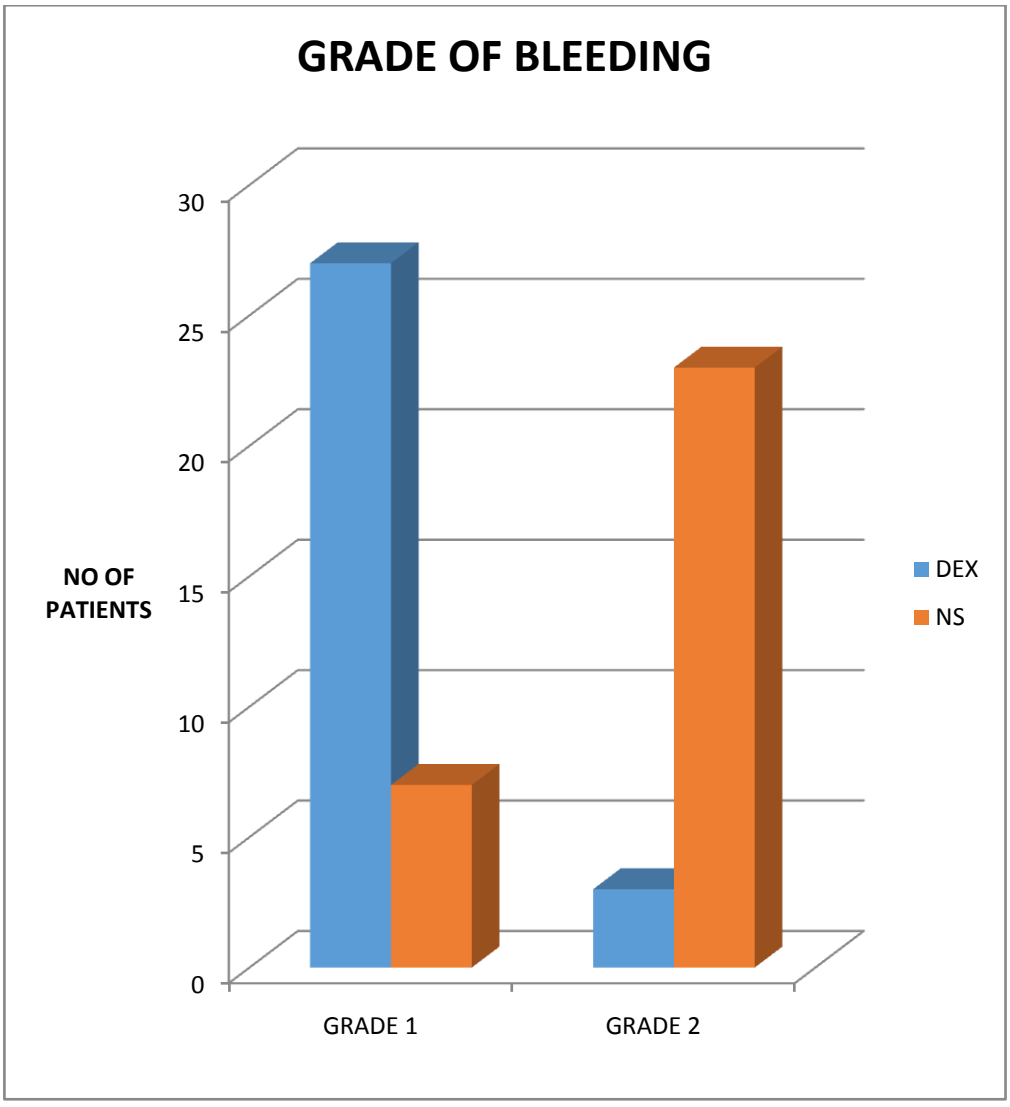


Table 9: Time to attain target blood pressure

S.No	Group name n=30/group	Time to achieve target BP (mean ± SD) minutes	p value	Statistical test
1	GROUP I(DEX)	24±7.24	<0.0001	Mann Whitney U test
2	GROUP II(NS)	48.67±8.60		

Time taken to achieve target blood pressure less than 30% of baseline systolic blood pressure or mean arterial pressure whichever was higher, were compared between two groups. Patients of dexmedetomidine group took an average of 24 minutes to reach target blood pressure, while patients of normal saline group took 48 minutes to reach target blood pressure. The results were compared. Mann –Whitney U test was used to test the level of significance (U=26) p value was <0.0001, hence statistically significant. Thus it is inferred that dexmedetomidine group required lesser time to attain target blood pressure than normal saline group.

Graph 15: Time to attain target blood pressure

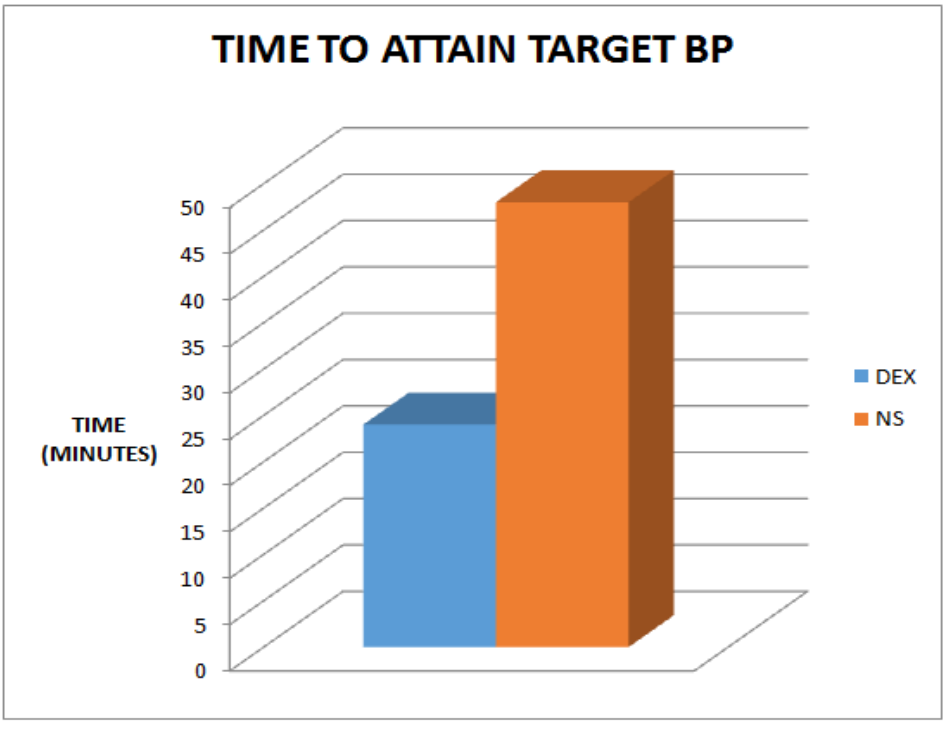
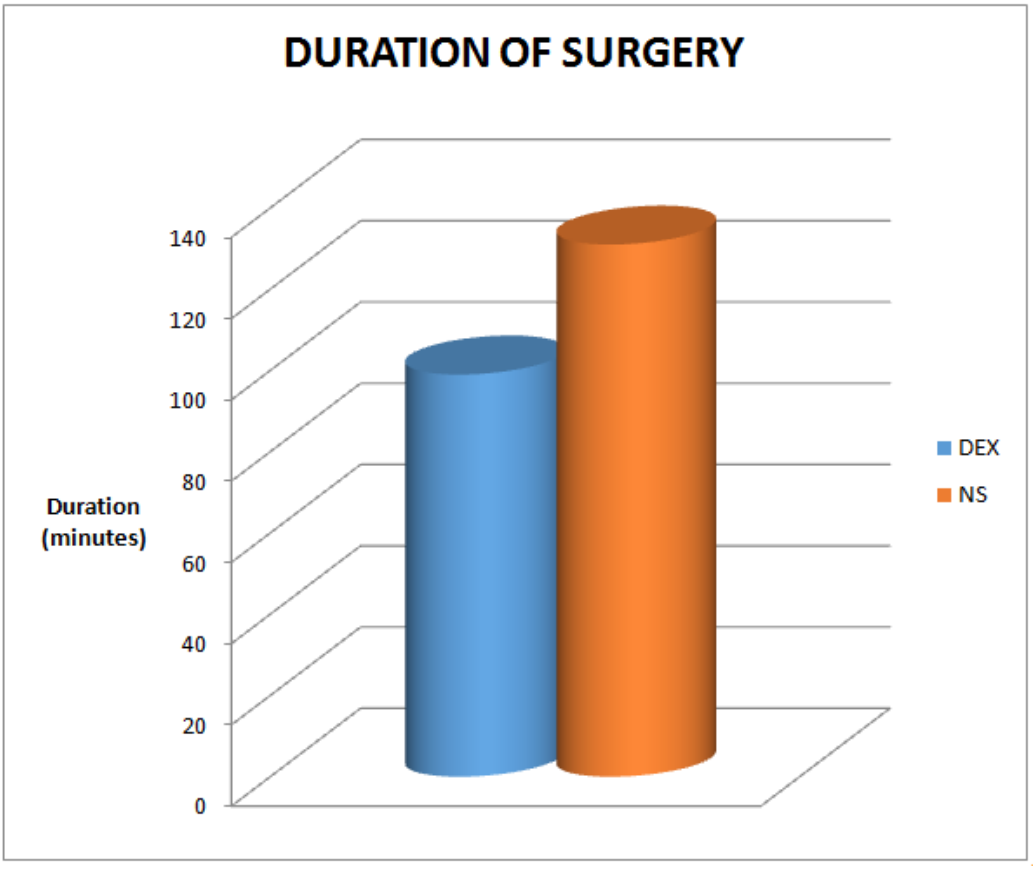


Table 10: Duration of surgery

S.No	Group	MEAN± S.D (minutes)	p value	Statistical Test
1	GROUP I(DEX)	99.01 ± 2.05	<0.0001	Student 't'test
2	GROUP II(NS)	131.7 ± 2.99		

The average duration of surgery in 30 patients of dexmedetomidine group were 99 minutes. The average duration of duration of surgery in 30 patients of normal saline group were 131 minutes. The results were compared. Student t test was used to test the level of significance (t=8.99) p value was <0.0001, hence statistically significant. The duration of surgery was significantly lower in dexmedetomidine group than normal saline group.

Graph 16: Duration of surgery



DISCUSSION:

Hypotensive anaesthesia during middle ear surgeries are preferred, as bloodless field provides optimal visualization under operating microscope. Relative bloodless field facilitates the placement of graft. Under operating microscope even a minimal bleed is visualised as major one hence it's a challenge to anaesthesiologist to provide bloodless field.

Various pharmacological means can be used to provide hypotensive anaesthesia, like directly acting vasodilators, beta blockers, calcium channel blockers, inhalational agents. Dexmedetomidine, an alpha 2 agonist acts by sympathetic suppression and provides good hemodynamic stability.

Not many studies have been conducted to study the effect of dexmedetomidine to provide controlled hypotension in middle ear surgeries. So we planned for a prospective, randomized study in Thanjavur medical college hospital, Thanjavur to study the effects of dexmedetomidine to provide bloodless field in middle ear surgeries under general anaesthesia.

60 ASA physical status I and II patients, aged between 18 -45 years planned for elective middle ear surgeries were enrolled in this study after obtaining consent. They were randomly allocated to one of the two study groups, group I (Dexmedetomidine) and group II(normal saline).

Patient characteristics across group:

The demographic characteristics like age, weight, gender, ASA of the study population were compared and results similar in both groups, with no statistically significant difference.

The mean age in group I (DEX) was 28.27 ± 7.31years, while in group II (NS) was 25.53 ± 7.3 years, which was comparable.

The mean weight in group I (DEX) was 56.33 ± 5.54 Kg, while in group II (NS) was 57.63 ± 4.9 kg, which was comparable.

Group I (DEX) had 17 males and 13 females while group II (NS) had 18 males and 12 females hence statistically comparable.

Group I (DEX) had 12 patients of ASA I status and 18 patients of ASA II status. Group II (NS) had 14 patients of ASA I status and 16 patients of ASA II, results were compared and statistically insignificant, hence comparable.

Dosage of drug:

Group I (DEX) patients received 0.5mcg/kg/hour infusion of dexmedetomidine- 50 mcg diluted in 100 ml normal saline after induction till 20 mins before the end of surgery. No loading dose was administered. Group II (NS) patients received 100 ml of normal saline after induction till 20 mins before the end of surgery.

Heart Rate:

In our study the baseline heart rate showed no statistical difference between both groups while intraoperative heart rate was significantly lower in dexmedetomidine group throughout the surgery, 10 minutes after induction till 10 minutes post extubation than normal saline group(p value<0.0001).

In a study by Gupta et al dexmedetomidine given at 0.5 mcg/kg/hour versus normal saline during middle ear surgeries showed comparable intraoperative mean heart rate in both the groups, with only 30^{th} and 60^{th} minute heart rate significantly lower in dexmedetomidine group, p value<0.05. The post extubation heart rate was lower in dexmedetomidine group than normal saline group, p value<0.05. In contrast our study showed, mean heart rate intraoperatively from 10 mins after induction to post extubation was significantly lower in the dexmedetomidine group than normal saline with p value <0.0001. While lower heart rate post extubation in this study was comparable with our study.

In a study by Shah et al , dexmedetomidine given at loading dose 1mcg/kg before induction followed by continuous infusion at 0.4mcg/kg/hour for middle ear surgeries compared to normal saline showed that

dexmedetomidine group had significantly lower pulse rate throughout the intraoperative period ($p<0.05$).The results were comparable with our study.

In a study by Bayram et al, dexmedetomidine versus magnesium sulphate infusion in controlled hypotension during functional endoscopic sinus surgery. Dexmedetomidine loading dose 1mcg/kg over 10 mins followed by 0.5 to 1 mcg/kg/hour infusion compared with magnesium sulphate loading dose 40 mg/kg followed by 10-15mg/kg/hour. The mean heart rate in dexmedetomidine group was lower intraoperatively than magnesium sulphate group, with p value <0.05. The results were comparable with our study.

In a study by Shams et al in induced hypotension for functional endoscopic sinus surgery, dexmedetomidine versus esmolol, dexmedetomidine was given loading dose of 1mcg/kg followed by continuous infusion of 0.4 to 0.8 mcg/kg/hour. Intraoperatively no statistically significant difference noted in heart rate between the two groups. In contrast, our study compares dexmedetomidine with normal saline and dexmedetomidine group show a statistically significant difference in mean lower heart rate than normal saline group.

Systolic, Diastolic, Mean arterial pressure:

In our study, our aim was not to compare the blood pressure between two groups intraoperatively. Our aim was to achieve target blood pressure in both groups, we observed that we could achieve target blood pressure in both groups, but there was difference in time taken to achieve target blood pressure and this was well evident on the graphical comparison of intraoperative systolic, diastolic and mean arterial pressure comparison between two groups (graph 8, 10, 12). Till target blood pressure was reached the normal saline group showed significant higher blood pressure than dexmedetomidine group, once target blood pressure was reached there was no statistical difference in blood pressures between both groups. This clearly demonstrates dexmedetomidine group achieves target blood pressure earlier and maintains a comparatively lower margin of blood pressure than normal saline group with sevoflurane only. Our set target blood pressure was less than 30% of baseline systolic blood pressure or mean arterial pressure which ever was higher.

Inhalational agent requirement analysis:

In our study we used sevoflurane as inhalational agent. The requirement of sevoflurane dial concentration among two groups to achieve and maintain target BP was compared. Dexmedetomidine group used 0.72±0.13% dial concentration of sevoflurane while normal saline group used 1.43±0.32% dial

concentration of sevoflurane to achieve and maintain target BP. Mann Whitney U test was used and dexmedetomidine showed statistically reduced requirement of sevoflurane to attain target blood pressure than normal saline.

In a study by Gupta et al, the required dial concentration of isoflurane was significantly reduced in dexmedetomidine group of patients than normal saline group to reduce systolic BP by 30% less than baseline values. It was 0.8±0.6% isoflurane in dexmedetomidine group while 1.6±0.7% in normal saline group to reduce systolic blood pressure 30% below baseline value, p value <0.05. The results were comparable to our study.

Nasreen et al studied dexmedetomidine infusion during middle ear surgery to provide hypotensive anaesthesia. In group of patients who received dexmedetomidine infusion 0.4mcg/kg/hour intraoperatively required 1.3±0.4% halothane while normal saline group required 3.1±0.3% halothane. Statistically significant reduction in requirement of halothane to reduce mean arterial pressure by 30% below baseline values in dexmedetomidine group than normal saline group, p value, 0.05. The results were comparable to our study.

Gupta et al used dexmedetomidine infusion for radical mastectomy to provide bloodless field and better field visibility. The consumption of isoflurane in dexmedetomidine group was 0.82±0.8% to maintain systolic blood pressure 100-110 mm Hg while patients of normal saline group required 1.5±0.9% to reach target systolic blood pressure. The results were statistically significant, p <0.05.The results were comparable to our study.

Na Kim young et al studied the effect of dexmedetomidine on sevoflurane requirements and emergence agitation in children undergoing ambulatory surgery. The end tidal sevoflurane concentration was significantly lower in Dexmedetomidine group (infusion at 0.1mcg/kg/hour) than normal saline group with p value <0.05.

Grade of bleeding:

In our study we observed that bleeding was significantly lesser with dexmedetomidine group than normal saline group. The blood loss was graded by surgeon at the end of the surgery, who was blinded to the study.

GRADE 0 - no bleeding – excellent.

GRADE 1- minimum bleeding – sporadic suctioning needed.

GRADE 2- diffuse bleeding – repeated suction needed.

GRADE 3- considerable troublesome bleeding and continuous suction was needed.

Out of 30 patients in dexmedetomidine group, 27 patients had grade 1 bleeding and 3 of them had grade 2 bleeding. But among 30 patients in normal saline group only 7 patients had grade 1 bleeding while 23 patients had grade 2 bleeding. The results were compared using chi square proportions test , p value <0.0001. Hence the grade of bleeding was significantly lesser with dexmedetomidine group than normal saline group.

Gupta et al, in his study the surgical site bleeding was assessed by surgeon during the procedure and graded. Among 32 patients from dexmedetomidine group 27 patients needed sporadic suctioning with minimal bleeding, while 5 patients had diffuse bleeding that needed repeated suctioning. In 32 patients of normal saline group, 3 patients had minimal bleeding, 22 of them had diffuse bleeding with repeated suctioning, and 7 of them had troublesome bleeding with continuous suctioning. Dexmedetomidine has significantly lower bleeding than normal saline group with p value <0.05. This is comparable to the results of our study.

Nasreen et al, in her study on comparing dexmedetomidine infusion with normal saline in 42 adult patients observed that, 7 patients in normal saline group had bloodless field not hampering surgery while 13 patients in dexmedetomidine group had it. 10 patients from normal saline group had mild bleeding requiring occasional suctioning while only 8 patients from dexmedetomidine group had grade II bleed. Excessive bleeding hampering surgery despite suctioning was seen in 4 patients in normal saline group while none in dexmedetomidine group had it. Hence the grade of bleeding was significantly lower in dexmedetomidine group and better visualization of field than normal saline group, p value<0.05.Tthe results were comparable with our study.

Sarkar et al studied the effectiveness of dexmedetomidine in controlling surgical site bleeding in middle ear surgeries with normal saline. Intraoperative bleeding scales were assessed every 10 mins and a final opinion on bleeding was assessed by surgeon. Intraoperative bleeding score and final opinion on bleeding score was significantly higher in placebo group than dexmedetomidine group, p value=0.000. The result of this study is comparable to our results.

Gupta et al in his study to observe the effect of dexmedetomidine on surgical site bleeding during modified radical mastectomy under I gel graded the surgical site bleeding intraoperatively 30 and 60 mins after the start of surgery. Patients who received dexmedetomidine showed significantly reduced bleed and better surgical field than normal saline group. p value<0.05. The results were comparable with our study.

Vineela et al studied the effect of controlled hypotension with dexmedetomidine versus nitroglycerin on intraoperative blood loss during FESS. Blood loss was measured as volume in suction bottle and weight of soaked swabs. Dexmedetomidine group had average blood loss of 137.33mL while nitroglycerin group had 152.9mL average blood loss. The difference in blood loss in two groups is statistically significant with p value <0.05. Hence dexmedetomidine provides better surgical field. The results were comparable with our study.

Time to reach target BP:

In our study, the hypotensive target was set as less than 30% reduction from baseline systolic BP or mean arterial BP which ever was higher. After

induction the time taken to achieve the target BP was compared between two groups. Dexmedetomidine group needed 24±7.24 mins to achieve target BP while normal saline group needed 48.67±8.6 mins to achieve target hypotensive BP. The results were compared using Mann-Whitney U test. Dexmedetomidine group needed lesser time to attain target BP than normal saline group, which was statistically significant with p value <0.0001.

Duration of surgery:

In our study, the duration of study was lesser with dexmedetomidine group 99.01 ± 2.05minsthan normal saline group 131.7 ± 2.99mins.Student 't' test was used to test the significance, p value <0.0001. Hence, statistically significant.

The duration of surgery is not dependent only on the surgical site bleeding. Multiple factors decide the duration of surgery. Hence the significant lesser duration of procedure cannot be attributed only to dexmedetomidine without analyzing other factors that influence it.

Incidence of adverse effects:

No significant adverse events like bradycardia, hypotension beyond target blood pressure, nausea, vomiting were not observed in any of the patients.

SUMMARY:

We conducted a prospective, double blinded randomized controlled study in 60 patients belonging to ASA I and II physical status undergoing elective middle ear surgeries in department of Oto-rhino laryngology, Thanjavur medical college hospital, Thanjavur. Patients of both sexes ranging between 18-45 years were included in our study. Our aim was to study the effect of dexmedetomidine in middle ear surgeries during general anaesthesia to provide bloodless surgical field

Ethical committee approval was obtained. Informed written consent was obtained from patients. Patients were divided into two groups of 30 each randomly by closed cover technique. Baseline vital parameters were measured. Group I (DEX) received infusion of dexmedetomidine at 0.5mcg/kg/hour in 100 ml normal saline after induction till 20 mins prior to end of surgery. Group II (NS) received a placebo of 100 ml normal saline infusion after induction till 20 mins prior to end of surgery.

Intraoperative heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, sevoflurane dial concentration were measured at 10 mins interval throughout the surgery. Post operative vitals parameters at the end of 10 minutes post extubation were recorded. Grade of bleeding was assessed by surgeon at the end of the surgery in a graded scale.

The obtained data were entered in Microsoft excel and statistical analysis done using SPSS (version 20).

The demographic data were comparable between two groups. Categorical data was analyzed using student‘t’ test and expressed in mean±S.D. Nominal variables were analysed using fischer test. Data were not statistically significant.

In our study we observed that the baseline heart rate was comparable between two groups while intraoperatively heart rate was significantly lower in dexmedetomidine group than normal saline group ($p < 0.0001$). Data are expressed as mean ± SD. Two-way ANOVA with bonferroni post hoc test was performed for the statistical significance.

Our aim was not to compare the systolic, diastolic blood pressure and mean arterial pressure in both groups. Time taken to attain the target blood pressure and sevoflurane requirements to attain target blood pressure were our factors of interest. Target blood pressures were achieved in both groups but there were intraoperative significant differences in both the groups from 10 -50 minutes of the procedure. This difference could be possibly because of the time taken by each group to attain the target hypotensive blood pressure.

The time taken to achieve the target blood pressure was significantly lower in dexmedetomidine group than normal saline group. The values were expressed as mean±S.D, Mann Whitney U test was used to test the level of significance (p value <0.0001). Hence statistically significant.

The requirements of sevoflurane to achieve target blood pressure in both groups were compared. Dexmedetomidine group required 0.72±0.13% dial concentration of sevoflurane to achieve target blood pressure, while normal saline group required 1.43±0.32% dial concentration of sevoflurane to achieve target blood pressure. Data are expressed as mean ± SD. Unpaired student 't' test was used to test the level of significance and $p<0.05$ is considered statistically significant. The t value obtained was 4.669 and p value was <0.0001 and hence statistically significant. Dexmedetomidine infusion reduces the requirement of volatile agent (sevoflurane) to reach target blood pressure.

The bleeding of surgical site was graded and assessed by surgeon at the end of the surgery. Out of 30 patients in dexmedetomidine group, 27 patients had grade 1 bleeding and 3 of them had grade 2 bleeding. But among 30 patients in normal saline group only 7 patients had grade 1 bleeding while 23 patients had grade 2 bleeding. Chi square test for proportions was used to analyze the data and p value was <0.0001, hence significant. Thus it shows dexmedetomidine infusion reduces the bleeding at surgical site and provides better visibility of the operative field.

The duration of surgery in dexmedetomidine group was 99.01±0.01 minutes, while in normal saline group was 131.7±2.99 minutes. Student t test was used to test the level of significance. p value was<0.0001,hence significant. But the lesser duration of surgery cannot be attributed only to dexmedetomidine or better surgical field as it is dependent on multiple factors.

No adverse effects were observed. No incidence of bradycardia requiring intervention with atropine was observed.

LIMITATIONS:

1. Only haemodynamic parameters were assessed under the study. Postoperative sedation and awakening time were not compared.
2. Duration of surgery was not completely reliable as it is not dependent only on bleeding at surgical site.
3. Cost effectiveness of dexmedetomidine was not analyzed.

CONCLUSION:

From the study it can be concluded that dexmedetomidine infusion at 0.5mcg/kg/hour infusion during general anaesthesia in middle ear surgeries,

1 .Reduces bleeding at surgical site and provides better visibility of the operative field under microscope than placebo.

2. Dexmedetomidine infusion reduces the requirement of sevoflurane to attain controlled hypotension.

3. Dexmedetomidine infusion helps to achieve the target controlled hypotension faster than with sevoflurane alone.

4. No adverse effects were observed.

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PROFORMA

NAME: AGE: SEX:

WEIGHT: GROUP:

COMORBIDITIES: ASA:

DIAGNOSIS:

PLAN: DURATION OF SURGERY:

PRE-OP :

HR :

BP :

SPO2 :

ECG :

TIME	HR	SBP	DBP	MAP	SEVOFLURANE

INTRAOPERATIVE BLEEDING

GRADE 0 : No bleeding

GRADE 1 : Minimum bleeding

GRADE 2 : Diffuse bleeding

GRADE 3 : Troublesome bleeding

POST OP :

HR :

BP :

SPO2 :

CONSENT FORM

I _____ hereby give consent to participate in the study being conducted by DR.ISHWARYA.J, post graduate in department of Anaesthesiology, Thanjavur medical college and hospital, Thanjavur and to use my personal clinical data and result of investigation for the purpose of analysis and to study the efficacy of drug. I also give consent for further investigations.

Place:

Date: Signature of participant

KEY TO ABBREVATIONS

ASA	American Society of Anaesthesiologist
F (sex)	Female
M (sex)	Male
HR	Heart rate
SBP	Systolic blood pressure
DBP	Diastolic blood pressure
MAP	Mean arterial pressure
NIBP	Non invasive blood pressure
ECG	Electrocardiograph
Mins	Minutes
DEX	Dexmedetomidine
NS	Normal saline

GROUP I(DEX)																		
S.NO	Age	Sex	Weight	ASA	Pre op HR	0 mins	10 mins	20 mins	30 mins	40 mins	50 mins	60 mins	70 mins	80 mins	90 mins	100 mins	Post op HR	
1	24	F	50	1	94	110	74	69	66	63	63	60	58	62	64		78	
2	31	F	63	2	82	100	80	81	77	70	72						81	
3	18	F	45	1	94	93	87	82	79	73	71	75	67	68	64	65	70	
4	44	F	65	2	88	84	82	76	69	68	64	64	60	60	61	62	71	
5	29	M	58	2	80	78	70	64	62	59	58	60	61	63	61		70	
6	28	M	62	2	83	87	81	67	63	62	60	60	60	61			67	
7	25	F	63	1	98	102	78	74	68	60	61	60	66	65	61		72	
8	38	F	58	2	92	98	80	68	64	63	62	61	62				71	
9	38	M	57	2	88	90	62	61	58	60	59	61	61	60			69	
10	28	M	65	2	78	88	68	64	63	63	64	60	62	61			65	
11	32	M	56	2	94	110	74	65	62	60	62	61	60	62			68	
12	19	F	48	1	90	98	73	70	86	64	62	58	60	61			66	
13	20	M	58	1	84	94	71	68	68	64	62	60	60	60			67	
14	21	M	50	1	80	98	68	62	56	58	59	61	61	63			64	
15	31	M	63	2	78	118	80	74	70	62	63	64	66	64	62		72	
16	30	F	58	2	74	114	70	65	60	60	61	59	61	60			68	
17	19	M	60	1	98	70	62	60	60	61	61	60	59	59			74	
18	18	F	54	1	88	108	68	65	63	61	58	59	60	60			62	
19	22	F	48	1	110	126	80	71	66	65	62	61	66	61			69	
20	33	F	60	2	74	98	74	72	68	65	61	63					63	
21	32	M	56	2	90	98	72	70	66	64	64	60	62	61			69	
22	26	F	52	2	84	98	75	73	66	61	60	61	62	63			68	
23	33	M	60	2	68	86	70	63	58	55	52	54	56	59			60	
24	40	F	62	2	90	98	71	66	60	61	65	70					72	
25	40	M	53	2	62	84	64	62	60	58	57	60					60	
26	23	F	52	1	84	114	76	70	65	63	62	63	60	62			69	
27	19	F	50	1	90	110	66	63	64	63	62	61	63				71	
28	32	M	59	2	74	96	76	71	66	65	65	64	63	68			68	
29	32	F	55	2	88	112	82	74	66	64	63	61	61	63	61		69	
30	23	F	50	1	78	110	80	74	72	68	65	62	60				70	

S.NO	pre op SBP	0 mins SBP	10 mins SBP	20 mins SBP	30 mins SBP	40 mins SBP	50 mins SBP	60 mins SBP	70 mins SBP	80 mins SBP	90 mins SBP	100 mins SBP	110 mins SBP	120 mins SBP	130 mins SBP	140 mins SBP	Post op SBP
1	124	132	108	95	90	90	89	91	92	93	98						108
2	120	126	98	92	87	90	93										114
3	120	110	102	104	97	92	90	88	92	90	86	88					102
4	120	120	100	92	94	90	92	90	88	87	90	91					110
5	120	110	93	90	93	91	92	88	89	90	90						100
6	125	126	106	100	96	92	91	89	84	95							101
7	120	130	108	91	90	92	90	90	84	85	92						107
8	118	130	110	90	88	89	90	88	90								102
9	120	140	92	90	86	88	89	90	91	93							106
10	110	130	90	89	88	84	81	80	90	91							105
11	124	132	98	90	88	89	90	91	90	95							108
12	110	128	98	93	91	87	88	86	90	91							105
13	120	136	96	93	90	89	84	81	91	92							104
14	112	130	102	89	86	85	86	90	92	94							106
15	124	152	132	100	90	84	89	96	100	92	90						108
16	110	128	92	90	90	88	85	88	91	93							102
17	122	132	102	90	88	89	90	91	91	93							102
18	130	132	92	90	89	88	85	89	89	90							105
19	130	140	92	90	89	87	81	80	90	94							110
20	130	136	100	86	81	80	82	89									103
21	120	126	96	95	90	88	83	82	90	90							110
22	120	130	100	91	88	89	90	91	94	95							109
23	132	140	101	92	90	90	89	86	93	96							107
24	120	132	101	90	84	85	84	90									106
25	130	150	110	100	90	90	89	90									112
26	110	124	94	90	88	85	84	83	93	96							107
27	110	124	94	90	88	82	80	81	88								103
28	120	130	100	90	88	86	82	86	90	96							110
29	120	134	104	89	88	85	90	89	90	93	96						109
30	110	130	100	90	89	88	85	86	90								100

S.NO	pre op DBP	0 mins DBP	10 mins DBP	20 mins DBP	30 mins DBP	40 mins DBP	50 mins DBP	60 mins DBP	70 mins DBP	80 mins DBP	90 mins DBP	100 mins DBP	110 mins DBP	120 mins DBP	130 mins DBP	140 mins DBP	Post op DBP
1	77	84	58	53	52	53	53	52	48	52	61						70
2	80	76	63	53	57	55	56										68
3	90	77	64	60	56	54	51	52	48	45	49	50					76
4	80	65	61	55	50	51	48	50	50	49	48	49					60
5	88	70	60	57	52	51	50	50	48	49	50						67
6	78	72	60	59	54	55	53	53	52	61							66
7	80	80	62	51	49	47	49	45	53	54	57						61
8	74	85	60	51	50	49	51	51	53								64
9	80	90	59	53	40	48	49	50	50	54							68
10	70	80	55	54	52	51	50	50	53	54							66
11	77	84	58	51	51	53	51	54	55	56							62
12	70	88	56	50	48	50	49	51	50	53							65
13	70	84	54	50	50	49	50	51	54	56							64
14	78	80	62	54	45	48	49	51	48	52							60
15	76	91	84	60	51	50	56	58	57	54	50						72
16	74	84	54	51	48	48	45	51	51	53							66
17	76	81	61	51	45	46	47	48	50	54							64
18	76	80	54	50	51	45	45	49	54	56							66
19	74	82	62	58	56	54	53	52	56	58							64
20	74	80	58	55	54	54	53	58									63
21	70	84	54	55	53	52	52	50	52	55							67
22	80	80	60	51	50	52	52	54	54	57							67
23	74	80	58	55	53	51	54	53	56	56							64
24	76	86	56	53	52	54	50	55									60
25	80	80	70	64	58	54	58	50									72
26	70	76	56	54	53	50	49	48	52	58							62
27	70	86	56	55	51	52	50	48	56								65
28	80	80	62	51	48	50	55	54	57	59							64
29	80	89	59	53	52	52	51	53	50	55	58						62
30	70	80	62	58	54	52	50	51	52								60

S.NO	pre op MAP	0 mins MAP	10 mins MAP	20 mins MAP	30 mins MAP	40 mins MAP	50 mins MAP	60 mins MAP	70 mins MAP	80 mins MAP	90 mins MAP	100 mins MAP	110 mins MAP	120 mins MAP	130 mins MAP	140 mins MAP	Post op MAP
1	92	100	74	67	64	65	65	65	62	65	73						82
2	93	92	74	67	67	66	68										83
3	100	88	76	74	69	66	64	64	62	60	61	62					84
4	93	83	74	67	64	64	62	63	62	61	62	63					76
5	98	83	71	68	65	64	64	62	61	62	63						78
6	93	90	75	72	68	67	65	65	62	75							77
7	93	96	77	64	62	62	62	60	63	64	68						76
8	88	100	76	63	62	62	64	63	68								76
9	93	106	70	65	55	61	62	63	63	67							80
10	83	96	66	65	64	63	61	60	65	66							79
11	92	100	71	64	63	65	64	66	66	69							77
12	83	101	70	64	62	62	62	62	63	65							78
13	86	101	68	64	63	62	65	63	66	68							77
14	89	96	68	65	58	60	61	64	62	66							75
15	92	111	100	73	64	61	67	70	71	66	63						84
16	86	98	66	64	62	61	58	63	64	66							78
17	91	98	74	64	59	60	61	62	63	67							76
18	94	97	66	63	63	59	58	62	65	67							79
19	92	101	72	68	67	65	62	61	67	70							79
20	92	98	72	65	63	62	61	68									76
21	86	98	68	68	65	64	62	60	64	66							81
22	93	96	73	64	62	64	64	66	67	69							81
23	93	100	72	67	65	64	65	64	68	69							78
24	90	101	71	65	62	64	61	66									75
25	96	103	83	76	68	66	68	63									86
26	83	92	68	66	64	61	60	59	64	70							77
27	83	98	68	66	63	62	60	58	66								77
28	96	96	74	64	61	62	64	64	68	71							79
29	93	104	74	65	64	63	64	65	63	67	70						77
30	84	96	74	68	65	64	61	62	64								73

S.NO	sevo % 20 mins	sevo % 40 mins	sevo %60 mins	sevo % 80 mins	sevo 100 mins	sevo % 120 mins	time to target BP(mins)	grade of bleeding	duration of surgery(mins)			
1	0.4	0.4	0.5	0.4			30	1	110			
2	0.5	0.5					30	1	70			
3	0.6	0.6	0.6	0.6	0.4		30	1	120			
4	0.4	0.5	0.5	0.5	0.4		30	1	120			
5	0.6	0.6	0.6	0.6			20	1	110			
6	0.6	0.6	0.6	0.6			50	2	100			
7	0.6	0.8	0.8	0.6			20	1	110			
8	0.6	0.8	1	0.8			20	1	90			
9	0.8	1	1	0.6			20	1	100			
10	0.6	0.8	0.8	0.4			10	1	100			
11	0.6	0.6	0.5				20	1	100			
12	0.6	0.8	0.8				30	1	100			
13	0.8	0.8	0.6				30	1	100			
14	1	1	0.8	0.6			20	1	100			
15	1	1	0.8	1			30	2	110			
16	0.8	0.6	0.6	0.6			20	1	100			
17	0.8	1	0.8	0.4			20	1	100			
18	0.8	1	0.6	0.4			20	1	100			
19	1	1	1	0.6			20	1	100			
20	1	0.6	0.6				20	1	80			
21	0.8	1	0.6	0.6	0.4		30	1	100			
22	1	1	0.8	0.6			20	1	100			
23	0.8	1	0.8	0.6			30	1	100			
24	1	0.8	0.8				20	1	80			
25	1	1	0.6				30	2	80			
26	1	0.8	0.8	0.4			20	1	100			
27	0.8	1	0.8	0.8			20	1	90			
28	0.8	0.8	0.8	0.6			20	1	100			
29	1	0.8	0.8	0.8			20	1	110			
30	0.8	0.6	0.6				20	1	90			

GROUP II (NS)																					
S.NO	Age	Sex	Weight	ASA	Pre op HR	0 mins	10 mins	20 mins	30 mins	40 mins	50 mins	60 mins	70 mins	80 mins	90 mins	100 mins	110 mins	120 mins	130 mins	140 mins	Post op HR
1	39	F	56	2	78	88	82	80	78	76	77	78	74	73	76	78	70	72	74	74	86
2	20	M	56	1	90	96	92	86	84	85	84	84	85	83	84	83	82	81	86	85	86
3	25	F	60	2	88	110	96	92	90	89	86	84	80	76	72	70	68	66			88
4	21	M	58	1	86	102	98	90	88	86	84	85	80	76	76	70	77	76			90
5	18	F	52	1	88	80	78	74	76	75	72	70	67	70	68	66	69	70	68		98
6	29	M	58	2	92	85	80	82	78	77	78	82	76	75	78	74	76	78	80		88
7	35	M	60	2	86	98	86	84	80	77	76	78	80	74	76	78					90
8	25	M	62	2	80	90	94	90	85	86	87	80	76	77	76	72	78	77			89
9	19	F	52	1	76	86	80	78	74	75	72	70	77	74	70						80
10	18	F	56	1	82	80	85	82	78	77	70	70	72	70	71	70	72	78	82		88
11	23	M	65	1	78	92	82	80	76	78	74	76	74	72	78	80					96
12	32	F	65	2	90	96	86	80	74	70	68	70	64	65	60	64	65	67			90
13	20	M	60	1	92	108	94	95	84	80	81	84	80	81	86	85					98
14	25	M	57	2	92	100	86	80	74	70	68	64	66	68	67	69					98
15	18	F	48	1	98	122	110	104	96	84	86	82	78	77	81	83	80				92
16	21	M	52	1	68	88	80	76	75	70	71	67	65	66	64	65					80
17	35	M	60	2	90	98	94	90	88	89	84	85	80	77	78	81	82	81			90
18	33	M	65	2	80	92	80	75	70	72	68	65	62	60	64	60					96
19	18	M	56	1	92	102	90	85	78	74	71	73	72	71	72	71	70				102
20	25	M	55	2	90	126	112	108	96	92	90	87	88	89	80	81	80				94
21	22	M	49	2	106	98	82	80	80	76	75	70	68	65	70	68	66				100
22	20	M	60	1	90	95	90	86	87	75	76	76	74	75	74						96
23	38	F	62	2	90	110	92	90	85	82	80	80	81	80	76	72	71				89
24	20	M	58	1	86	98	90	81	80	78	70	68	70	71	68	73					92
25	36	F	52	2	86	119	122	112	105	92	80	81	80	80	78	81	80				85
26	25	M	65	2	78	95	90	80	82	81	80	77	75	73	76	70	81	80			86
27	42	F	65	2	86	102	90	92	84	85	80	78	79	77	70	68	70	72	70		88
28	20	F	51	1	90	110	86	80	77	76	73	72	66	67	70	69					95
29	18	M	56	1	88	96	92	90	88	84	85	80	81	80	78	79	81	82			90
30	26	F	58	2	82	84	82	80	76	74	75	74	70	72							108

S.NO	pre op SBP	0 mins SBP	10 mins SBP	20 mins SBP	30 mins SBP	40 mins SBP	50 mins SBP	60 mins SBP	70 mins SBP	80 mins SBP	90 mins SBP	100 mins SBP	110 mins SBP	120 mins SBP	130 mins SBP	140 mins SBP	Post op SBP
1	110	124	110	122	102	95	90	88	88	87	85	82	86	90	96	108	140
2	110	133	122	112	106	96	90	86	89	86	89	86	90	91	99	102	128
3	110	142	128	107	95	89	85	86	88	83	92	90	96	97			112
4	120	133	124	109	106	95	90	91	89	90	88	90	98	98			120
5	130	110	100	98	95	92	90	91	91	89	90	88	88	90	100		122
6	120	110	106	108	106	95	90	90	89	88	90	93	99	102	105		130
7	110	112	100	108	96	92	91	87	88	90	102	108					114
8	120	116	122	112	100	94	92	90	91	88	90	100	103	102			140
9	130	110	100	92	90	90	91	92	96	102	104						120
10	110	118	122	116	96	92	90	91	92	93	93	95	96	102	110		120
11	120	122	112	100	92	90	92	90	85	88	91	102					122
12	120	124	112	100	96	90	92	91	88	89	88	90	92	93			120
13	124	133	122	112	92	93	88	88	93	95	105	106					112
14	120	18	108	104	94	93	91	87	89	92	93	96					130
15	120	140	130	116	106	98	96	90	89	86	94	96	97				120
16	110	130	108	102	100	95	93	90	87	92	93	95					124
17	130	151	140	128	97	94	91	90	88	88	91	100	101	101			130
18	116	118	108	103	96	93	90	91	93	90	92	96					120
19	122	133	112	108	103	100	96	90	90	93	102	103	105				141
20	112	150	110	133	120	110	92	88	93	90	88	84	89				132
21	130	144	120	112	96	90	96	90	91	90	91	92	94				130
22	120	126	102	102	100	92	90	91	90	96	97						110
23	110	130	112	122	98	91	88	89	85	90	90	94	110				120
24	110	128	106	102	100	96	90	88	95	96							120
25	110	140	136	120	115	95	90	86	91	90	92	96	98				120
26	122	120	133	110	100	94	91	90	91	90	88	93	105	110			110
27	140	150	120	133	122	102	101	98	90	88	90	90	91	100	101		126
28	110	124	102	100	105	90	90	88	88	90	94	98					120
29	120	130	112	108	98	92	90	88	93	93	90	91	96	99			120
30	116	110	100	96	92	91	87	92	91	96							118

S.NO	pre op DBP	0 mins DBP	10 mins DBP	20 mins DBP	30 mins DBP	40 mins DBP	50 mins DBP	60 mins DBP	70 mins DBP	80 mins DBP	90 mins DBP	100 mins DBP	110 mins DBP	120 mins DBP	130 mins DBP	140 mins DBP	Post op DBP
1	70	86	70	71	64	58	54	52	50	51	50	54	48	56	62	63	80
2	70	84	80	74	70	61	55	54	55	56	52	50	56	57	62	59	80
3	70	86	80	71	66	58	53	55	56	54	51	50	54	58			70
4	80	84	82	78	66	63	60	54	53	56	53	50	66	69			70
5	80	70	66	62	66	60	58	61	53	54	51	53	57	56	60		82
6	80	70	68	64	66	61	58	56	57	58	50	51	64	65	64		80
7	70	74	70	70	61	55	53	50	54	58	65	65					80
8	80	76	84	78	60	58	54	52	51	53	56	53	58	61			90
9	80	70	70	61	57	52	49	50	59	63	64						80
10	80	76	71	72	60	56	52	50	51	54	55	54	56	65	62		82
11	70	84	70	60	57	54	51	50	55	59	57	65					84
12	80	78	70	64	62	60	58	57	57	54	51	58	60	63			76
13	76	81	71	70	62	58	53	51	55	54	57	60					73
14	80	78	64	62	58	56	51	53	51	54	53	58					80
15	70	84	79	72	64	61	60	53	54	52	56	57	60				80
16	70	90	68	60	63	53	51	49	50	54	55	53					80
17	80	83	80	82	66	63	55	49	56	56	55	56	57	60			80
18	76	72	64	60	60	56	52	50	51	48	52	54					84
19	69	70	61	56	51	50	48	49	48	54	51	54	56				73
20	74	91	72	78	74	71	63	60	51	50	50	51	52				78
21	80	81	71	64	60	54	58	52	51	51	53	56	58				80
22	74	76	64	63	58	55	54	53	53	56	57						70
23	70	80	70	71	62	57	55	56	53	56	53	56	66				80
24	70	76	80	60	58	54	50	51	57	59							78
25	70	92	84	70	61	53	51	50	51	48	54	58	58				80
26	80	80	91	70	61	57	51	50	54	55	54	56	57	60			70
27	80	90	81	84	78	64	60	56	60	59	51	50	53	55	57		84
28	70	78	60	58	53	51	50	49	51	51	56	58					70
29	80	80	74	66	61	57	56	53	52	51	50	52	58	59			74
30	78	70	62	54	50	50	53	50	50	58							80

S.NO	pre op MAP	0 mins MAP	10 mins MAP	20 mins MAP	30 mins MAP	40 mins MAP	50 mins MAP	60 mins MAP	70 mins MAP	80 mins MAP	90 mins MAP	100 mins MAP	110 mins MAP	120 mins MAP	130 mins MAP	140 mins MAP	Post op MAP
1	83	98	83	88	76	70	66	64	62	63	61	63	60	67	73	78	96
2	83	100	94	86	82	72	66	64	66	66	64	62	67	68	74	73	96
3	83	104	96	83	75	68	63	65	66	63	64	63	68	71			84
4	93	100	96	88	79	73	70	66	65	67	64	63	76	78			87
5	96	83	77	74	75	70	68	71	65	65	64	64	67	67	73		95
6	93	83	80	78	79	72	68	67	67	68	63	65	75	77	77		96
7	83	86	80	82	72	67	65	62	65	68	77	79					91
8	93	89	96	89	73	70	66	64	64	64	67	68	73	74			106
9	96	83	80	71	68	64	63	64	71	76	77						93
10	90	90	88	86	72	68	64	63	64	67	67	67	69	77	78		94
11	86	96	84	73	68	66	64	63	65	68	68	77					96
12	96	93	84	76	73	70	69	68	67	65	63	68	70	73			90
13	92	98	88	84	72	69	64	63	67	67	73	75					86
14	96	91	78	76	70	68	64	64	63	66	66	70					96
15	86	102	96	86	78	73	72	65	65	63	68	70					93
16	83	103	81	74	75	67	65	62	62	66	67	67					94
17	96	105	100	97	76	73	67	62	66	66	67	67	71	73			96
18	89	87	78	74	72	68	64	63	65	62	65	68					96
19	86	91	78	73	68	66	64	62	62	67	68	70	72				95
20	86	110	84	96	89	84	72	69	67	63	62	62	64				96
21	96	102	87	80	72	66	70	64	64	64	65	68	70				96
22	89	92	78	76	72	67	66	65	65	69	70						83
23	83	96	84	86	74	68	66	67	62	67	65	68	80				93
24	83	93	88	74	72	68	63	63	69	71							92
25	83	108	101	86	79	67	64	62	64	62	66	72	71				93
26	94	93	105	83	74	69	64	63	66	66	65	68	73	76			83
27	100	110	94	100	98	76	73	70	70	68	64	63	65	70	71		98
28	83	93	74	72	70	64	63	62	63	64	68	71					84
29	93	96	86	80	73	68	67	64	65	65	63	65	70	72			89
30	90	83	74	68	63	63	64	64	63	70							92

S.NO	sevo % 20 mins	sevo % 40 mins	sevo %60 mins	sevo % 80 mins	sevo 100 mins	sevo % 120 mins	sevo % 140 mins	time to target BP(mins)	grade of bleeding	duration of surgery(mins)
1	0.8	1	1.5	1.5	1.5	1.5	0.8	50	2	160
2	1	1.5	1.5	1.5	1.5	1.5	0.8	50	2	160
3	1.5	2	2	2	2	1		40	1	140
4	1.5	1.5	1.5	1.5	1.5	0.8		40	2	140
5	1.5	1.5	2	2	1.8	1		50	1	150
6	1	1.5	2	2	2	1.5		50	2	150
7	1	1.5	1.5	1.5	0.8			60	2	120
8	1	1.5	2	2	2	1		60	2	140
9	1	1.5	1.5	1				30	2	110
10	1	1.5	1.5	1.5	1.5	1		50	2	150
11	1	1	1	1	0.6			40	2	120
12	1	1.5	1.5	1.5	1	0.8		40	1	140
13	1.5	1.5	1.5	1.5	0.8			50	2	120
14	1.5	2	2	1.5	1			50	2	120
15	1.5	2	2	2	1			60	2	130
16	1	1.2	1.2	1	0.8			60	1	130
17	1	2	2.5	2.5	2	1		50	2	140
18	1	1	1	1	0.8			50	2	120
19	1	1.5	1.5	1.5	1	1		60	2	140
20	1.5	2.5	3	3	2.5			60	2	130
21	1	1.5	1.5	1.5	1			40	2	130
22	1	1.5	1.5	1.5	1			50	1	100
23	1	1.5	1.5	1.2	1			50	2	130
24	1	1.5	1.5	1				50	2	130
25	1.2	2	2	2	1			50	2	100
26	1	1.5	2	2	1.5	0.8		50	2	140
27	1	2	2.5	2.5	2.5	2		60	2	150
28	1	1.5	1.5	1				40	1	120
29	1.5	1.5	1.5	1.5	1.5			40	2	140
30	1	1.5	1.5	0.8				30	1	100